SKYHAVEN AIRPORT MASTER PLAN UPDATE

DRAFT ALTERNATIVES ANALYSIS

February, 2009

Prepared for:

BUREAU OF AERONAUTICS

Visit the Past, Experience the Future!

New Hampshire DOT

Prepared by:

Jacobs Edwards and Kelcey
In Association with
The Smart Associates

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4.1 Introduction

Building on the forecasts of demand and facility requirements prepared previously, a number of facility requirements were identified. That analysis identified 'unconstrained' requirements. In order to determine the optimum airport layout and configuration, a series of alternatives were developed and analyzed in this chapter. The alternatives presented are intended to identify operational benefits and examine them in relation to potential constraints. This process allows stakeholders and decision makers to evaluate options and select the preferred alternative, as well as guide airport development into the future to meet anticipated demand and associated facility requirements.

The alternatives analysis focused on specific operational facilities of the airport:

1. The ultimate length and width of Runway 15-33, and the length of the parallel taxiway, including installation of run-up pads;
2. Enhancement of a new LPV (Localizer Performance Vertical Guidance) GPS Instrument Approach Procedure to Runway 33 with an installation of an approach light system;
3. Transient aircraft parking apron;
4. Enhance aircraft fueling procedures and facilities;

4.2 Runway 15-33 and Parallel Taxiway Alternatives

The existing Runway 15-33 is 4,001 feet long and 100 feet wide. The 2001 Airport Master Plan Update (AMPU) and Airport Layout Plan (ALP) prepared by Hoyle Tanner & Associates included a 500 foot runway extension to both Runway 15 and 33, for a total extension of 1,000 feet. The runway extension was also included in the Environmental Assessment (EA) and wetlands mitigation agreement[1] that was prepared after the 2001 AMPU.

The 2001 AMPU presented a range of forecast scenarios, and noted that the runway extension would be justified if the High Growth Scenario were realized. In that scenario, aircraft operations were projected to reach 74,280 by 2010. Analysis of aircraft activity levels from 2001 to 2008 indicated that demand did not increase at the rate predicted by the High Growth Scenario, and in fact the number of total aircraft operations declined slightly since 2001, from approximately 18,592 to 17,000. In addition, there were less than 20 operations (takeoffs and landings) by turbine-powered aircraft between July 2007-June 2008.

The forecasted level of demand presented in this AMPU concluded that corporate jet aircraft operations at Skyhaven Airport would not meet FAA's threshold for justification of a runway extension until the end of the planning period, approximately 2025. The FAA requires a minimum of 500 takeoffs and landings (operations) per year in order to designate critical design aircraft. The forecasts of demand for Skyhaven Airport indicate that, under the most recent high growth scenario, total operations by turbine-powered aircraft (including both turboprops and jets) may reach 500 operations by 2025. Of that total, more than 50% of those aircraft can operate on the existing 4,000 foot runway with little or no weight penalty.

[1] The mitigation agreement is discussed in more detail below.

However, if corporate aviation activity were to resume its previous growth rate (more than 6% per year) nationally and regionally, and if certain improvements were made at Skyhaven Airport, such as construction of transient aircraft parking space, in addition to other factors, it is possible that sufficient demand by corporate jet aircraft could be achieved that could justify a runway extension by the end of the planning period (2025), or shortly thereafter.

Current FAA criteria for new instrument approaches notes that the minimum runway length needed in order to achieve approach minimums as low as 200 feet and ½ mile is 4,200 feet. While it is not anticipated that those specific minimums will be published by the FAA in the near future at Skyhaven Airport, extending the runway by 200 feet would at least maintain the option of achieving those minimums in the future. Other factors that are required to achieve those minimums include certain types of runway and approach light systems, obstacle clearance standards, and pavement markings, etc.

Three alternatives were analyzed regarding future runway length:

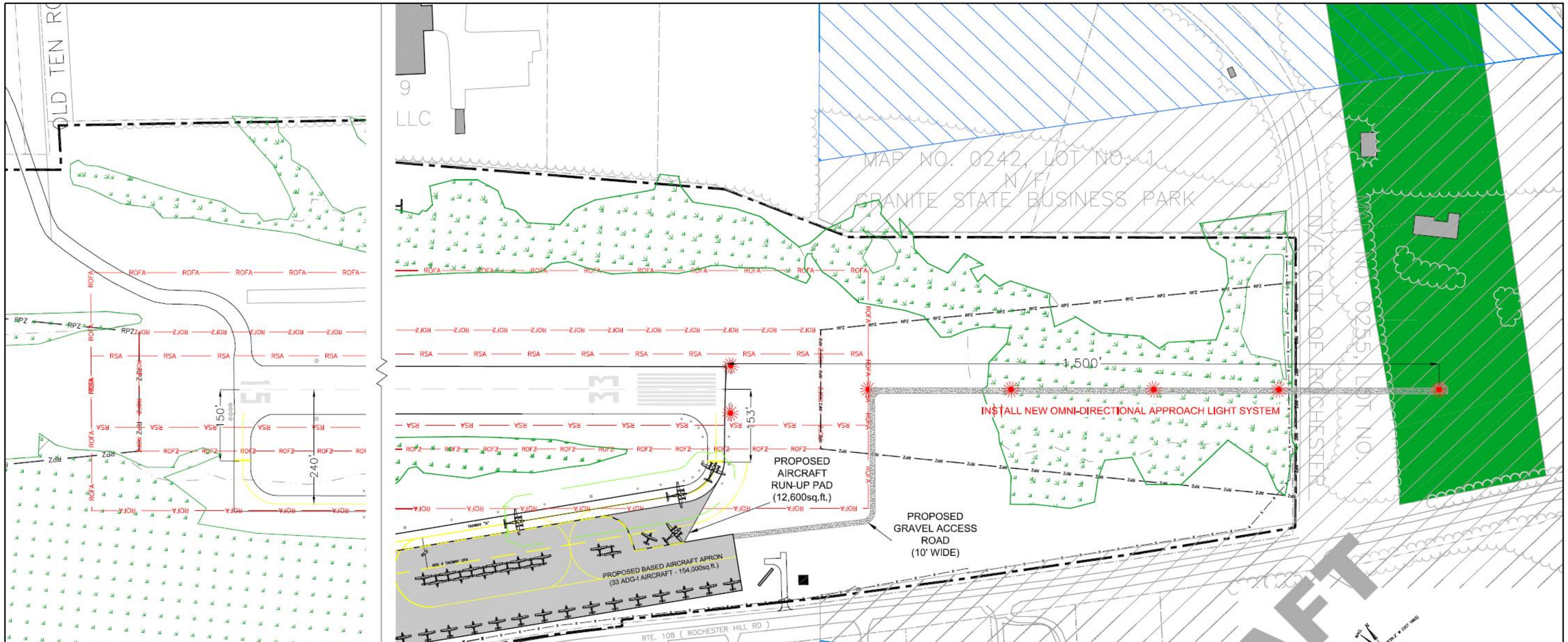
1. Maintain existing runway length of 4,000 feet
2. Extend Runway 15 by 500 feet, and extend Runway 33 by 200 feet, for a total length of 4,700 feet.
3. Extend Runway 15 by 500 feet. Within this option, a 200 foot extension to Runway 15 was also considered, as discussed further below.

The 700 foot extension alternative (Alt. 2) was analyzed because it could provide operational benefits to certain corporate jets in terms of allowing additional payload (passengers and baggage) as well as fuel on takeoff, and would also fall within the existing wetlands mitigation agreement. For example, a Hawker 4000 is a new corporate jet that holds up to 14 passenger seats and has a maximum takeoff weight of 37,500 lbs. It could takeoff on Skyhaven's 4,000 foot runway with 14 passengers and baggage and approximately 8,000 lbs of fuel, enough to fly approx. 2,200 nm. If Runway 15-33 were 4,700 feet long it could takeoff with an additional 2,500 lbs of fuel (a total of 10,500 lbs.), enough to fly 2,800 nm.

If either Runway 15 or 33 were extended further than discussed in Alternative 2 or 3, additional wetlands and water quality impacts would result, as well as additional penetrations to the imaginary surfaces.

4.2-1 Alternative 1 – No Runway Extension

Alternative 1 considers a full reconstruction of Runway 15-33 at its current length of 4,000-feet. The pavement on Runway 15-33 is more than 20 years old and is in need of rehabilitation or reconstruction within the next five years (by 2014). As noted previously in this AMPU, approximately 50% of the turbine-powered corporate aircraft currently in production can takeoff and land on a 4,000 foot runway with relatively little or no weight penalty. Other corporate jets can operate on a 4,000 foot runway if they reduce takeoff weight in the form of fewer passengers, baggage, or less fuel.



RUNWAY 15 END

RUNWAY 33 END

LEGEND

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	PAVEMENT EDGE		PARCELS
	RUNWAY CENTERLINE		AVIGATION EASEMENT 34:1
	PAVED ROAD		AVIGATION EASEMENT 7:1
	FENCE		PROPOSED PAVEMENT
	TREE LINE		PROPOSED PARCEL AQUISITION
340	INDEX CONTOUR (TYP)		OMNI-DIRECTIONAL APPROACH LIGHT (360° STROBE LIGHT)
	RETAINING WALL		PROPOSED GRAVEL ACCESS ROAD (10' WIDE)
ROFA	RUNWAY OBJECT FREE AREA		BUILDING
ROFZ	RUNWAY OBSTACLE FREE ZONE		WETLANDS (FIELD VERIFIED)
RPZ	RUNWAY PROTECTION ZONE		MOVEMENT AREA DELINEATION
RSA	RUNWAY SAFETY AREA		TAXIWAY OFA
	AIRPORT PROPERTY LINE		26-FOOT WINGTIP SEPARATION LIMIT

RUNWAY OPTION 1 - RECONSTRUCT RUNWAY TO 4,001' x 100' (NO EXTENSION). ADD ODALS TO RUNWAY 33 APPROACH END.

IMPERVIOUS SURFACES/ WETLANDS		
ACTION	IMPERVIOUS SURFACE ADDED/DELETED (SQ.FT.)	WETLAND IMPACT (ACRES)
ADD ODALS	3	.15
NET GAIN/LOSS	3	.15

NOTES:
1.) STATE PLANE, NAD 83 (HORIZONTAL), NEW HAMPSHIRE, US SURVEY FEET NAVD 88 (VERTICAL)
2.) FIELD VERIFICATION OF WETLAND BOUNDARIES, AUGUST 2008 - THE SMART ASSOCIATES
3.) ALL ELEVATIONS ARE MSL UNLESS OTHERWISE NOTED
4.) PARCEL DATA PROVIDED BY CITY OF ROCHESTER PLANNING AND ZONING DEPT. GIS - 2008

HORIZONTAL SCALE
1"=100'
100' 0 50' 100' 200'

SKYHAVEN AIRPORT
ROCHESTER, NH

ALTERNATIVE RUNWAY
OPTION 1
(4,001' x 100')

JACOBS One Sundial Avenue, Suite 410
Manchester, New Hampshire 03103
(603) 666-7181 FAX-(603) 666-7185

DRAWN BY:	CHKD. BY:	DWG. NO: 1
SCALE: AS SHOWN	APPROVED:	DATE: JAN 2009

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The FAA design criteria for runway width for Airport Reference Code (ARC) B-II is 75 feet. Runway 15-33 is currently 100 feet wide. The runway provides 89.3% coverage in all-wind conditions, and with no crosswind runway there are operational benefits to maintaining the current 100-foot width for aircraft landing and taking off in crosswind conditions, particularly for piston-engine aircraft which generate the large majority of operations at Skyhaven Airport. However, constructing the runway 75 feet wide would cost an estimated $754,860 less than reconstructing it 100 feet wide, and would also result in 100,000 s.f. less impervious surface (see **Appendix A** for the cost estimate breakdowns).

Table 4-1

Alternative 1 – No Runway Extension				
Future Runway Dimension	**Operational Benefits/Constraints**	**Cost Estimate**	**Environmental Impacts**	
			Impervious surface	Wetland impact
4,000’ x 100’	No change.	$3.83M	No increase	No change
4,000’ x 75’	Less flexibility in crosswind conditions.	$3.07M	-100,000 s.f.	No change
Note: cost estimates are approximate and subject to change. The cost estimates are not to be used for bidding or capital budgeting purposes. See Appendix A for cost estimate breakdowns.				

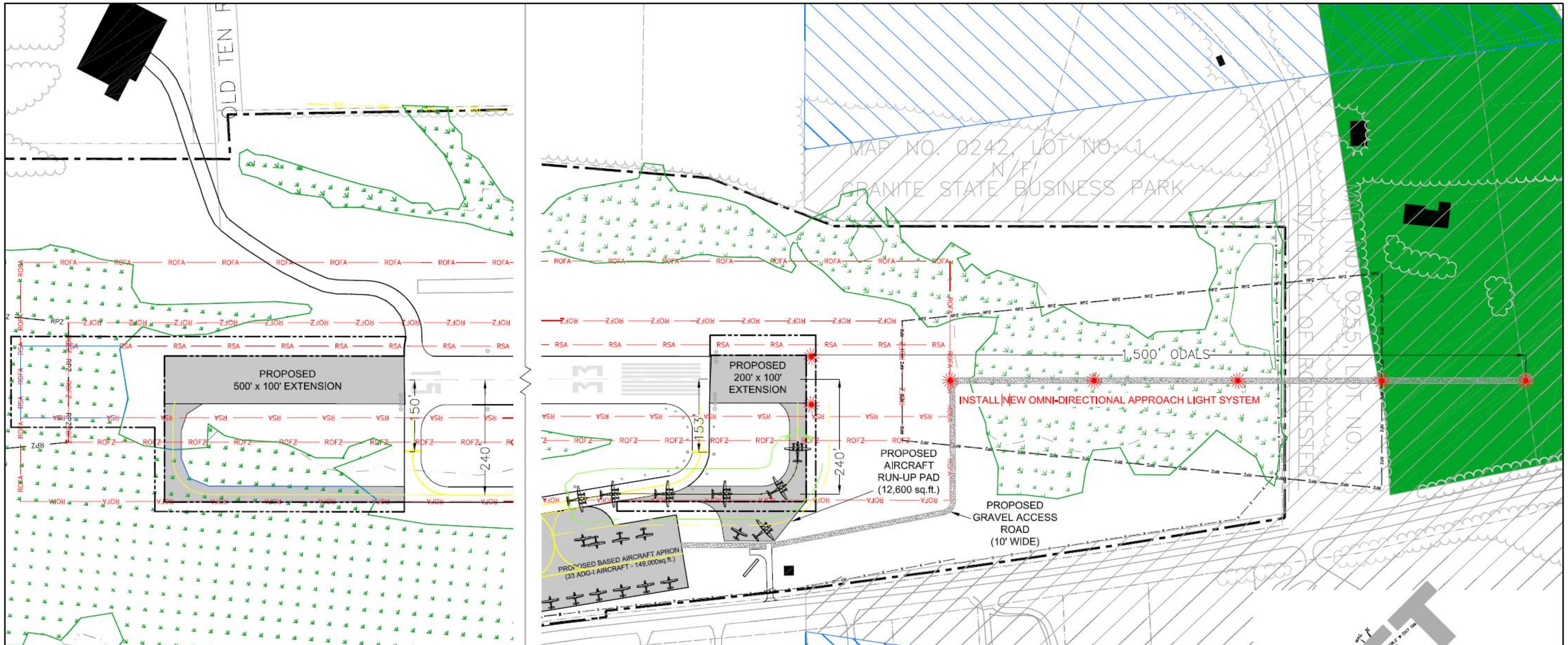
4.2-2 Alternative 2 – Maximize Runway Length (Extend Runway 15 x 500 feet & Extend Runway 33 x 200 feet)

Table 4-2

Alternative 2 – Extend Runway 15-33 by 700’				
Future Runway Dimension	**Operational Benefits/Constraints**	**Cost Estimate**	**Environmental Impacts**	
			Impervious surface	Wetland impact
4,700’ x 100’: Extend Runway 33 by 200’ and Runway 15 by 500’ + extend the parallel taxiway by 700’.	Increased payload on takeoff for some corporate aircraft + increased landing length*; Additional FAR Part 77[2] and TERPs[3] penetrations; RPZ extends off airport.[4]	$5.25M	+ 111,500 s.f.	2.4 acres
* See the example of a Hawker 4000 corporate jet above. Note: cost estimate includes the parallel taxiway as well as runway extension. The cost estimates are approximate and subject to change. The cost estimates are not to be used for bidding or capital budgeting purposes. See Appendix A for cost estimate breakdowns.				

This alternative provides a 700-foot extension to Runway 15-33 along with full runway safety areas (RSA’s) and extension of the parallel taxiway. Under this alternative the Runway 33 end would be extended by 200 feet, and Runway 15 would be extended by 500 feet. Extending the Runway 33 threshold by 200 feet, as well as the runway safety area and parallel taxiway, would not impact wetlands.

[2] 14 CFR Federal Aviation Regulations Part 77 Objects Affecting Navigable Airspace
[3] United States Standard for Terminal Instrument Procedures, FAA Order 8260.3B and Order 8260.54A
[4] Runway Protection Zone (RPZ)



RUNWAY 15 END

RUNWAY 33 END

RUNWAY OPTION 2 - EXTEND RUNWAY 33 THRESHOLD 200' AND ADD ODALS. EXTEND RUNWAY 15 500' WITH ASSOCIATED SAFETY AREA AND TAXIWAY EXTENSIONS.

LEGEND

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	PAVEMENT EDGE		PARCELS
	RUNWAY CENTERLINE		AVIGATION EASEMENT 34:1
	PAVED ROAD		AVIGATION EASEMENT 7:1
	FENCE		PROPOSED PAVEMENT
	TREE LINE		PROPOSED PARCEL AQUISITION
340	INDEX CONTOUR (TYP)		OMNI-DIRECTIONAL APPROACH LIGHT (360' STROBE LIGHT)
	RETAINING WALL		PROPOSED GRAVEL ACCESS ROAD (10' WIDE)
ROFA	RUNWAY OBJECT FREE AREA		BUILDING
ROFZ ROFZ	RUNWAY OBSTACLE FREE ZONE		WETLANDS (FIELD VERIFIED)
RPZ	RUNWAY PROTECTION ZONE		MOVEMENT AREA DELINEATION
RSA	RUNWAY SAFETY AREA		TAXIWAY OFA
	AIRPORT PROPERTY LINE		26-FOOT WINGTIP SEPARATION LIMIT

IMPERVIOUS SURFACES/ WETLANDS

ACTION	IMPERVIOUS SURFACE ADDED/DELETED (SQ.FT.)	WETLAND IMPACT (ACRES)
EXTEND RUNWAY 33 BY 200'	20,100	0.0
EXTEND PARALLEL TAXIWAY TO 33 END	17,000	0.0
EXTEND RUNWAY 15 BY 500'	50,000	0.0
EXTEND RUNWAY 15 SAFETY AREA	0	1.03
EXTEND PARALLEL TAXIWAY TO 15 END	24,400	1.37
ADD ODALS	3	.15
NET GAIN/LOSS	111,503	2.55

NOTES:
1.) STATE PLANE, NAD 83 (HORIZONTAL), NEW HAMPSHIRE, US SURVEY FEET NAVD 88 (VERTICAL)
2.) FIELD VERIFICATION OF WETLAND BOUNDARIES, AUGUST 2008 - THE SMART ASSOCIATES
3.) ALL ELEVATIONS ARE MSL UNLESS OTHERWISE NOTED
4.) PARCEL DATA PROVIDED BY CITY OF ROCHESTER PLANNING AND ZONING DEPT. GIS - 2008

HORIZONTAL SCALE
1"=100'
100' 0 50' 100' 200'

SKYHAVEN AIRPORT
ROCHESTER, NH

ALTERNATIVE RUNWAY
OPTION 2
(4,701' x 100')

JACOBS
One Sundial Avenue, Suite 410
Manchester, New Hampshire 03103
(603) 666-7181 FAX-(603) 666-7185

DRAWN BY:	CHKD. BY:	DWG. NO: 2
SCALE: AS SHOWN	APPROVED:	DATE: JAN 2009

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The extension of Runway 15 was limited to 500-feet to minimize the impacts to the adjacent wetland system. In addition, any further extension of Runway 15 beyond 500 feet would increase the number of penetrations to the FAA imaginary surfaces. The extended runway pavement itself does not impact adjacent wetlands, however it does add 50,000 sq. ft. of impervious surface, which could impact water quality.

The extended runway safety area (RSA) and parallel taxiway extension to Runway 15 *would* impact an estimated 2.4 acres of wetlands. Of that total, just the extension of the parallel taxiway to the new Runway 15 threshold would impact 1.37 acres (approx.) of wetlands, and add approximately 24,400 sq. ft. of impervious surface. The construction of the extended runway safety area (RSA) per current FAA design standards (300’ long x 150’ wide) would impact approximately one acre of wetland. It was assumed that the wetland area between the taxiway and runway extension would be disturbed in its entirety.

Best management practices (BMP’s) such as the use of porous pavement, underground detention/retention systems, vegetated swales, and vegetated filter strips, etc., could mitigate the potential impacts, as discussed in more detail below. Some of those options, such as porous pavement, are not currently eligible for FAA AIP grants. However, they may provide sufficient environmental benefits to be considered during the design process.

The on-airport wetlands were field verified in August 2008 by The Smart Associates, and served as the basis to determine the extent and type of wetland areas that would be impacted by the various alternatives. All of the on-airport wetlands are all considered to be palustrine, emergent, persistent, seasonally flooded/saturated (PEM1E, as classified by the *Classification of Wetlands and Deepwater Habitats of the United States*).

Even with the amount of wetland disturbance identified above, a 700 foot runway extension would fall within with the limits set by the wetland mitigation agreement[5] currently in place between the NHDOT and the NH Department of Environmental Services (DES). As noted above, no wetland impacts on the Runway 33 end would result from the 200-foot runway extension or associated RSA, but the impervious surface added would be approximately 20,100 sq. ft. Even if an alternative falls within the limits of the wetlands mitigation agreement, dredge and fill permits would be required prior to the construction of any extension.

A 500-foot extension of Runway 15 would have an impact on the FAA’s instrument departure surface[6] for Runway 33. This is a surface intended to protect aircraft taking off on Runway 33 under instrument meteorological conditions (IMC). If Runway 15 were extended by 500 feet, the number of penetrations to the instrument departure surface would increase by an additional 780 objects (approximately – primarily trees). If the penetrations are not removed, FAA could designate non-standard takeoff minimums and/or a steeper climb gradient for aircraft departing on Runway 33 under IMC. Aircraft that meet FAA’s departure performance criteria could still

[5] The previously approved airport master plan update, environmental assessment (EA), and mitigation agreement between NHDOT and NHDES included an extension of Runway 33 by 500 feet and an extension of Runway 15 by 500 feet. Any future extension of the runway that generates fewer impacts on wetlands and water quality than identified in the mitigation agreement would not require an additional EA or wetland mitigation.

[6] Source: FAA Advisory Circular 150/5300-13, *Airport Design*, Appendix 2, Table A2-1 Approach/Departure Requirements Table, Row 11

depart under IMC, and those aircraft that do not meet the FAA departure criteria could depart when the weather improved to specified conditions.

Other penetrations to obstacle clearance surfaces would occur as well with a runway extension. Additional penetrations to the FAR Part 77 imaginary surfaces and FAA Terminal Instrument Procedure (TERPs) surfaces could have a negative effect on the existing published instrument approach procedures, and also prevent further instrument approach enhancements unless the penetrations were removed.

In particular, a 200 foot extension to Runway 33 would result in penetrations to the FAA's Glidepath Qualification Surface (GQS). The objects would be primarily trees located off-airport, which would require easement acquisition in order to remove. FAA will not publish a new LPV instrument approach if there are penetrations to the GQS surface. In addition, the airport sponsor would have to provide new survey data to the FAA and certify that the applicable imaginary surfaces are free of penetrations.

For those objects outside of the GQS surface that penetrate other imaginary surfaces and that could not be removed, a marking and lighting plan would need to be submitted to and approved by FAA. Based on that plan FAA could issue a determination that certain penetrations could be marked and lighted, as opposed to removed. For those penetrations located off-airport, easements would be required in order to mark or light the objects. A description of the FAR Part 77 and TERPs imaginary surfaces applicable to Skyhaven Airport are included in **Appendix B**.

If Runway 33 were extended by 200 feet to the south, the Runway Protection Zone (RPZ) would extend off airport property and cross Airport Drive onto an adjacent private parcel of land. The function of the RPZ is to provide for controlled land use by the airport sponsor in order to protect people and property on the ground. Airport Drive would need to be realigned to remain outside of the RPZ, and property would need to be acquired in order to be compliant with current FAA RPZ criteria.

Any additional extension of Runway 33 beyond 200 feet to the south would result in additional penetrations to the FAA imaginary surfaces, and move the RPZ further off-airport, which would require additional easements and/or property acquisition. Such an extension would also result in additional wetlands and water quality impacts. If an omni-directional approach light system (ODALS) were installed on Runway 33, the additional extension would move the lights further to the south off-airport and further on to private property.

4.2-3 Alternative 3 – Extend Runway 15 by 500 Feet

Table 4-3

<table>
<tr><th colspan="5">Alternative 3 – Extend Runway 15 by 500’</th></tr>
<tr><th rowspan="2">Future Runway Dimension</th><th rowspan="2">Operational Benefits/Constraints</th><th rowspan="2">Cost Estimate</th><th colspan="2">Environmental Impacts</th></tr>
<tr><th>Impervious surface</th><th>Wetland impact</th></tr>
<tr><td>4,500’ x 100’: Extend Runway 15 by 500’ + the parallel taxiway</td><td>Allows some increased payload on certain corporate aircraft + increased landing length. Increased FAR Part 77[7] and TERPs[8] surface penetrations</td><td>$4.87M</td><td>+74,400 s.f.</td><td>2.4 acres</td></tr>
<tr><td colspan="5">Note: cost estimate include the parallel taxiway as well as the runway extension. The cost estimates are approximate and subject to change. The cost estimates are not to be used for bidding or capital budgeting purposes. See Appendix A for cost estimate breakdowns.</td></tr>
</table>

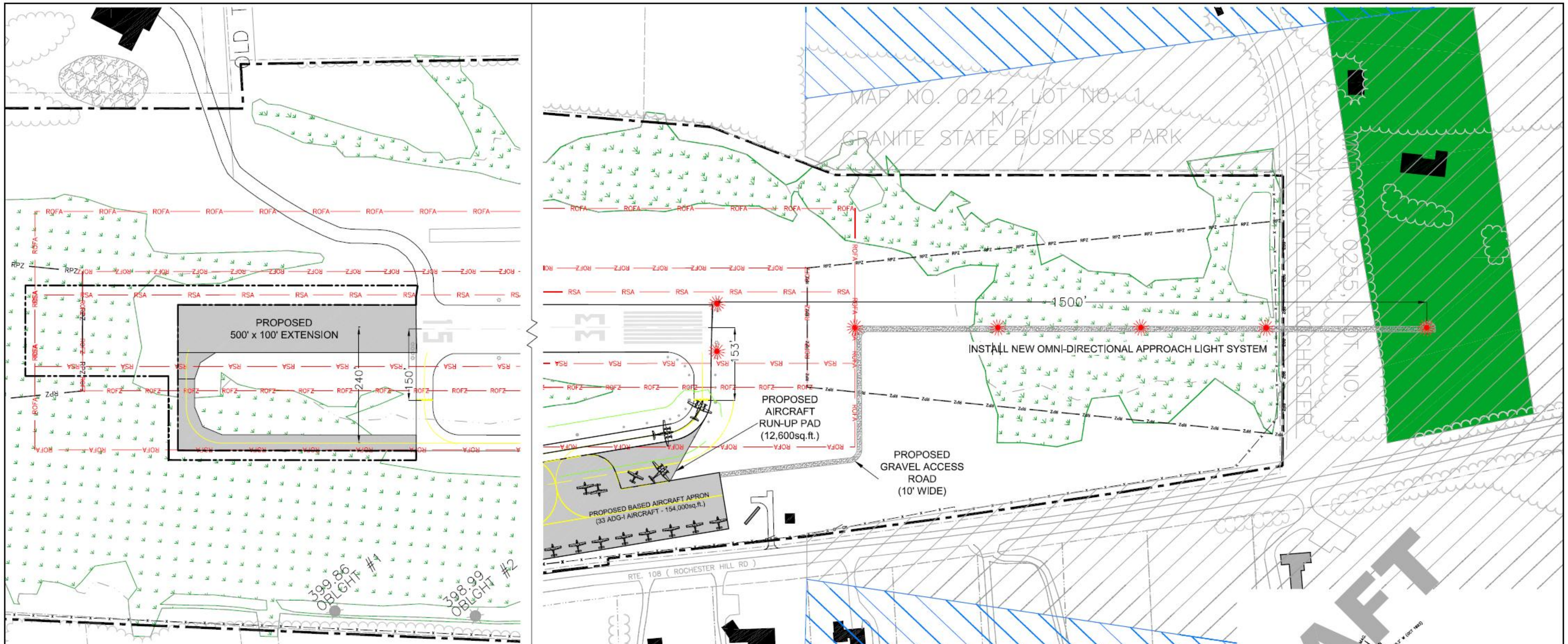
Alternative 3 provides a 500-foot extension to Runway 15 with associated runway safety area (RSA) and extended parallel taxiway. This alternative would leave the Runway 33 threshold in its current position, and it provides a ‘median’ between Alternatives 1 and 2. It has the same wetland impacts as Alternative 2 but with 37,100 sq. ft. less impervious surface, and is also less expensive to construct. Compared with Alternative 1, there would be 2.4 additional acres of wetland impact, and the additional cost to construct the extension would be $1.12M.

Many of the same operational benefits and constraints identified in Alternative 2 also apply to Alternative 3. In particular, both options would result in increased penetrations to the Runway 33 instrument departure surface and require additional property and/or easement acquisition. However, by extending only Runway 15 and keeping the existing Runway 33 threshold in place, the RPZ for Runway 33 would remain on-airport. Also, by keeping the existing threshold for Runway 33 at its current location, no additional impacts to the Runway 33 FAR Part 77 or TERPS airspace surfaces would be generated.

Extend Runway 15 by 200 Feet

As noted previously, FAA criteria currently requires a minimum runway length of 4,200’ in order to receive an instrument approach with minimums as low as 200’ and ½ mile. While it is not anticipated that Skyhaven Airport will achieve those instrument approach minimums in the near-term, extending Runway 15 by 200’ would leave that option open for the future. A 200’ extension to Runway 15 would cost approximately $415,000 and result in fewer wetland and water quality impacts, and also provide less benefit in terms of increased payload for certain jets on takeoff.

[7] 14 CFR Federal Aviation Regulations Part 77, *Objects Affecting Navigable Airspace*
[8] *United States Standard for Terminal Instrument Procedures*, FAA Order 8260.3B and Order 8260.54A



RUNWAY 15 END

RUNWAY 33 END

LEGEND

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	PAVEMENT EDGE		PARCELS
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	PAVED ROAD		AVIGATION EASEMENT 7:1
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RSA	RUNWAY SAFETY AREA		TAXILANE OFA
	AIRPORT PROPERTY LINE		26-FOOT WINGTIP SEPARATION LIMIT

RUNWAY OPTION 3 - EXISTING RUNWAY 33 THRESHOLD, ADD ODALS. EXTEND RUNWAY 15 500' WITH ASSOCIATED SAFETY AREA AND TAXIWAY.

IMPERVIOUS SURFACES/ WETLANDS

ACTION	IMPERVIOUS SURFACE ADDED/DELETED (SQ.FT.)	WETLAND IMPACT (ACRES)
EXTEND RUNWAY 15 BY 500'	50,000	0.0
EXTEND RUNWAY 15 SAFETY AREA	0	1.03
EXTEND PARALLEL TAXIWAY TO 15 END	24,400	1.37
ADD ODALS	3	.15
NET GAIN/LOSS	74,403	2.55

NOTES:
1.) STATE PLANE, NAD 83 (HORIZONTAL), NEW HAMPSHIRE, US SURVEY FEET NAVD 88 (VERTICAL)
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HORIZONTAL SCALE
1"=100'
100' 0 50' 100' 200'

SKYHAVEN AIRPORT
ROCHESTER, NH

ALTERNATIVE RUNWAY
OPTION 3
(4,501' x 100')

JACOBS One Sundial Avenue, Suite 410
Manchester, New Hampshire 03103
(603) 666-7181 FAX-(603) 666-7185

DRAWN BY: | CHKD. BY: | DWG. NO: 3
SCALE: AS SHOWN | APPROVED: | DATE: JAN 2009

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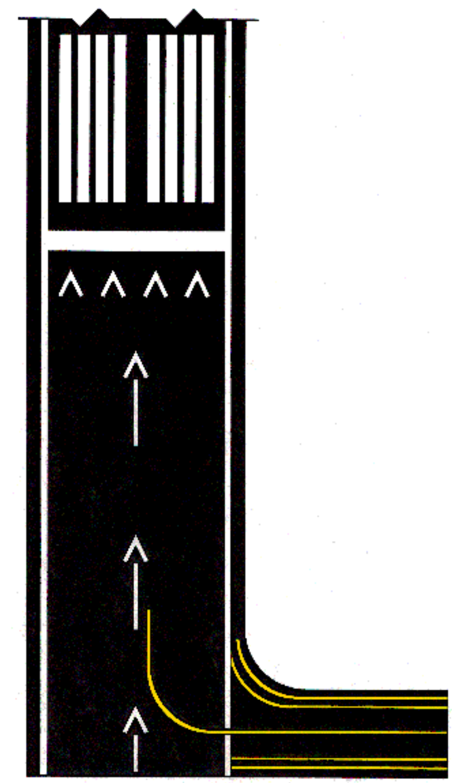
Runway 15 Displaced Threshold Option

Figure 4-1 Displaced Threshold



The primary impact to wetlands due to an extension of Runway 15 by 500 feet would be from the runway safety area. If the runway were extended by 500 feet, but the threshold were displaced by an equal amount (illustrated), it is possible that the runway safety area would not require extending, thereby reducing wetlands impacts.

The runway behind the displaced threshold (marked with arrows) could be used for takeoff on Runway 15, as well as landing rollout on Runway 33, but could not be used by aircraft landing on Runway 15. The cost to construct the extension would be the same as shown above, and the parallel taxiway should also be extended to threshold. The displaced threshold could also be used in conjunction with a threshold siting surface, which could reduce some of the vegetation that may have to be removed in the FAR Part 77 approach surface. That would not, however, eliminate the penetrations to the Runway 33 instrument departure surface, described above. In addition, FAA promotes construction of full runway safety areas, particularly on new runway projects (e.g. runway reconstruction, extension, etc.).

Raise Runway Thresholds

One option that was considered for both the existing and extended runway alternatives was raising the runway thresholds in order to reduce the number and extent of penetrations to the FAA imaginary surfaces. The FAA has established maximum grades for taxiways and runways, and for the purposes of this analysis it was assumed that the stub taxiways to the runway ends could be reconstructed and elevated at the same time the runway was reconstructed and/or extended.

The analysis concluded that the Runway 33 threshold could be elevated by approximately 7 feet, and the Runway 15 threshold could be elevated by approximately 8 feet. The overall runway would also be higher than the existing elevation. The associated runway safety area would also need to be reconstructed and graded per FAA criteria. The stub taxiways could be reconstructed to connect the higher runway thresholds to the existing parallel taxiway, and could remain within the grade limits set by FAA.

A conceptual grading plan showing the new runway and safety area profiles is attached. The analysis was based on existing data, and is considered to be an approximate layout of the possible runway grade. In order to finalize the actual increase in runway elevation, additional site specific engineering data, including survey, would need to be acquired. The runway profile and data shown here are not to be used for design or construction purposes.

Raising the runway thresholds would also raise the imaginary surfaces associated with each runway end by a similar amount, which would reduce the number and extent of penetrations to the imaginary surfaces.

However, many of the existing penetrations are vegetation (primarily trees), and will continue to grow. If left in place, many of the trees could grow as much as 10 feet within 10 years, which is a greater height than the runway thresholds can be elevated. Therefore, raising the runway thresholds is a temporary solution to reducing penetrations.

The cost estimate to raise the runway, including the thresholds and the stub taxiways and the runway safety area, is approximately $1,100,000 (4,000’ long x 100’ wide). This cost is in addition to the cost to reconstruct the runway in its current location.

If Runway 15 were extended by 500 feet, the cost estimate to raise the runway is approximately $1,250,000 (4,500’long x 100’ wide). This cost is in addition to the cost to construct the runway extension.

4.2-4 Installation of Omni-Directional Approach Light System (DOALS) on Runway 33 Alternative

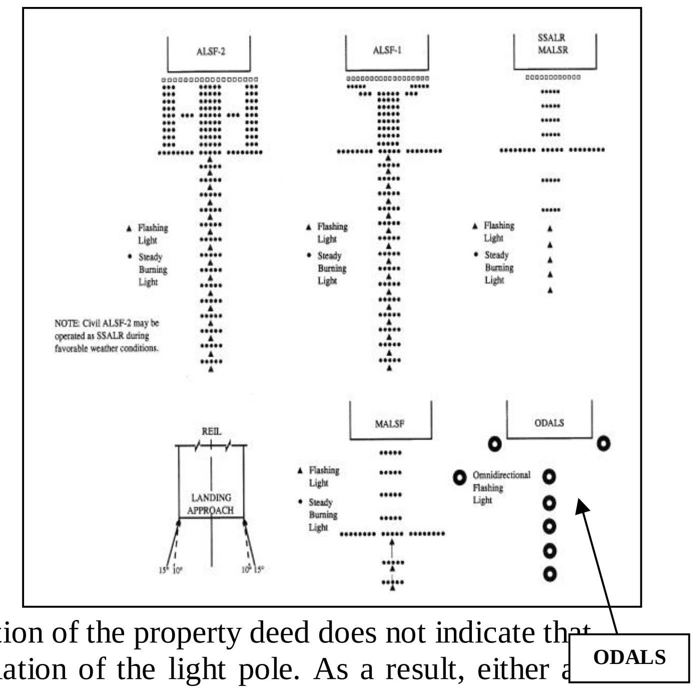
The FAA has indicated that it will publish a new global positioning system (GPS) LPV instrument approach to Runway 33, scheduled for October 2009. FAA has indicated that the minimums for the new LPV (Localizer Performance Vertical Guidance) approach will be approximately 300 feet (above the runway threshold) and 1 mile visibility. The current lowest GPS approach minimums are 438 feet and 1 mile.

If an Omni-directional Approach Light System (ODALS) were installed to Runway 33, it would allow for a reduction in the approach visibility minimums to ¾ mile. This ¼ mile reduction would provide operational benefits for landing aircraft by allowing pilots to continue the approach and land at Skyhaven Airport under instrument meteorological conditions (IMC) when the visibility is between 1 and ¾ mile. When visibility is less than ¾ mile, pilots will use other airports with lower approach minimums.

Table 4-4

Runway 33 Omni-Directional Approach lights (ODALS)				
Item	**Benefits/Impacts**	**Cost Estimate**	**Additional Impervious Surface**	**Wetlands Impacts**
Add Omni-direction Approach Lights and gravel service road	Visibility minimums reduced by ¼ mile. Need to acquire easement or property; potential light emission impacts.	$80,000	<.15 acres	.15 acres
Note: cost estimates are approximate and subject to change. The cost estimates do not include easement or property acquisition. The cost estimates are not to be used for bidding or capital budgeting purposes. See Appendix A for cost estimate breakdowns.				

Figure 4-2 Approach Light Systems



ODALs are the most compact of the FAA-approved approach light systems (see graphic). ODALS consist of five poles, on top of each one is a single white omni-directional flashing light. The first pole is located 300-feet from the runway threshold, and the poles are spaced 300-feet apart, for a total system length of 1,500 feet from the threshold. At the runway threshold, the existing runway end identifier lights (REILs) will remain in place. Installation of an ODALS, or a reduction in visibility minimums, would not change any of the imaginary surfaces. The ODALS light plane would need to be clear of vegetation or other objects.

If the Runway 33 threshold remains in its present location, the fifth light pole would be located off-airport, on private property. Examination of the property deed does not indicate that an easement presently exists to allow the installation of the light pole. As a result, either an easement or the parcel of property would need to be acquired. If Runway 33 were extended 200 feet to the south, two lights poles would be located on two different off-airport parcels. The acquisition of easements or parcels of property were not included in the cost estimate for the ODALS shown above. In addition, a gravel service road would need to be constructed to allow for the installation and servicing of the lights and poles.

4.2-5 Aircraft Run-up Pad Alternatives

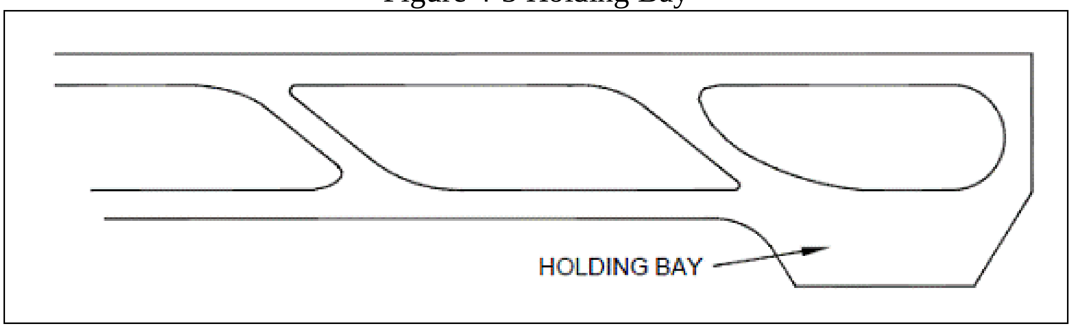
Aircraft run-up pads (or holding bays) could potentially be located beside the taxiway at each runway end (Figure 4-3). The operational benefits to providing run-up pads (or holding bays, as illustrated below) allow aircraft to do pre-takeoff run-ups and wait for Air Traffic Control (ATC) clearances while other airplanes are able to access the runway.

At Skyhaven Airport, Runway 33 is the primary use runway and has the greatest need for run-up pad, which could be sized to accommodate 2 single or multi-engine piston aircraft or one turboprop such as a Beech King Air. The pad would be approximately 12,600 s.f. in size, and the construction cost estimate is approximately $164,000.

A run-up pad beside the taxiway adjacent to the Runway 15 threshold could impact wetlands, but a run-up pad beside the 33 threshold would not impact wetlands. A run-up pad beside the Runway 33 threshold would reduce delays during peak periods and would generate little increase over existing noise levels. If a new based aircraft tiedown apron were constructed (discussed below), a run-up pad on the Runway 33 end would not increase impervious surface.

Run-up pads need to be located outside of the taxiway obstacle free zone (OFZ), taxiway and runway safety area, and not interfere with any navigation aid. Although existing and projected peak hour traffic levels at Skyhaven Airport do not meet the threshold identified by FAA[9] (a minimum of 30 operations per hour), the bays would be eligible for FAA funding and would provide operational benefits, particularly if additional turbine-powered aircraft use the airport. Not constructing run-up pads would reduce construction costs and slightly reduce impervious surface.

Figure 4-3 Holding Bay



4.3 Based Aircraft Tiedown and Transient Parking Apron Alternatives

One of the most significant operational constraints identified on the airport in the previous chapters of this Master Plan Update was the lack of transient aircraft parking space. In order to accommodate additional transient aircraft activity, particularly by corporate aircraft, a separate transient parking apron will be needed.

The terminal area recommendations presented in the 2001 Master Plan Update were examined, and in order to provide adequate transient parking various additional alternatives were identified and analyzed in this master plan. Based on its current condition, there is a need to reconstruct the existing based aircraft tiedown apron within the next five years (by 2014), which provides an opportunity to examine alternatives for additional paved parking.

[9] Source: FAA AC 150/5300-13, Airport Design, Chapter 4, Taxiway and Taxilane Design, para. 409, Holding Bays

Two alternatives were identified: A. reconstruct the existing apron and continue its present use, and B. reconstruct the existing tiedown apron and convert it into paved transient parking, and construct a new based aircraft tiedown apron.

The existing paved based aircraft tiedown apron is 98,700 sq. ft. in size, and accommodates 28 tiedowns. The apron pavement is more than 20 years old and is in poor condition and consequently is in need of reconstruction, as noted in previous chapters of this report. The avgas 100LL and Jet A self-serve fuel pumps are located on the apron, and aircraft using the fuel pumps maneuver in the area in front of the pumps. The current apron configuration generates inefficient operations between aircraft taxiing to/from their tiedowns, aircraft using the fuel pumps (some of which are maneuvered by hand), and aircraft trying to find transient parking space. As a result, Alternative A would constrain existing and future transient operations, particularly by turbine-powered aircraft.

There is a need to provide transient aircraft parking if the airport is to accommodate more corporate aircraft, such as the Beech King Air turboprop or jet aircraft such as the Cessna Citation Excel or Hawker 4000, etc. These aircraft require paved (vs. turf or gravel) parking, and also prefer not to maneuver in close proximity to piston-engine aircraft while taxiing to/from parking because of possible jet blast and blowing debris on smaller airplanes.

There is not enough room to park transient aircraft on the existing apron since the majority of tiedowns are occupied by based aircraft. The fuel pumps occupy a large portion of the remaining apron, and aircraft using the fuel pumps occupy a portion of the remaining apron space. The 2001 AMPU identified a need for additional paved based aircraft tiedowns, but did not identify a separate transient aircraft parking apron.

In general, transient pilots and passengers prefer to have close access to the terminal building and ground transportation, and the existing based tiedown apron is adjacent to the terminal building. There are also gates in the security fence that would allow convenient vehicular access to transient aircraft for the loading and unloading of luggage and cargo, etc.

Alternative B involves converting the existing based aircraft apron to transient aircraft parking, with designated parking positions for turboprops and corporate jets as well as single and multi-engine piston airplanes (i.e., airplane design group I – wingspan <49’, and airplane design group II – wingspan 49’ - <79’).

Four dedicated parking positions for turbine-powered corporate aircraft such as the Beech King Air, Cessna Citation Excel, etc., could be provided (see Figure 4-1, below). The transient parking layout shown below was configured to fit within the boundaries of the existing paved based tiedown and refueling apron beside the terminal building. The existing retaining wall remains in place. This apron layout assumes that the self-serve fuel pumps and fuel storage tanks would be relocated to another site.

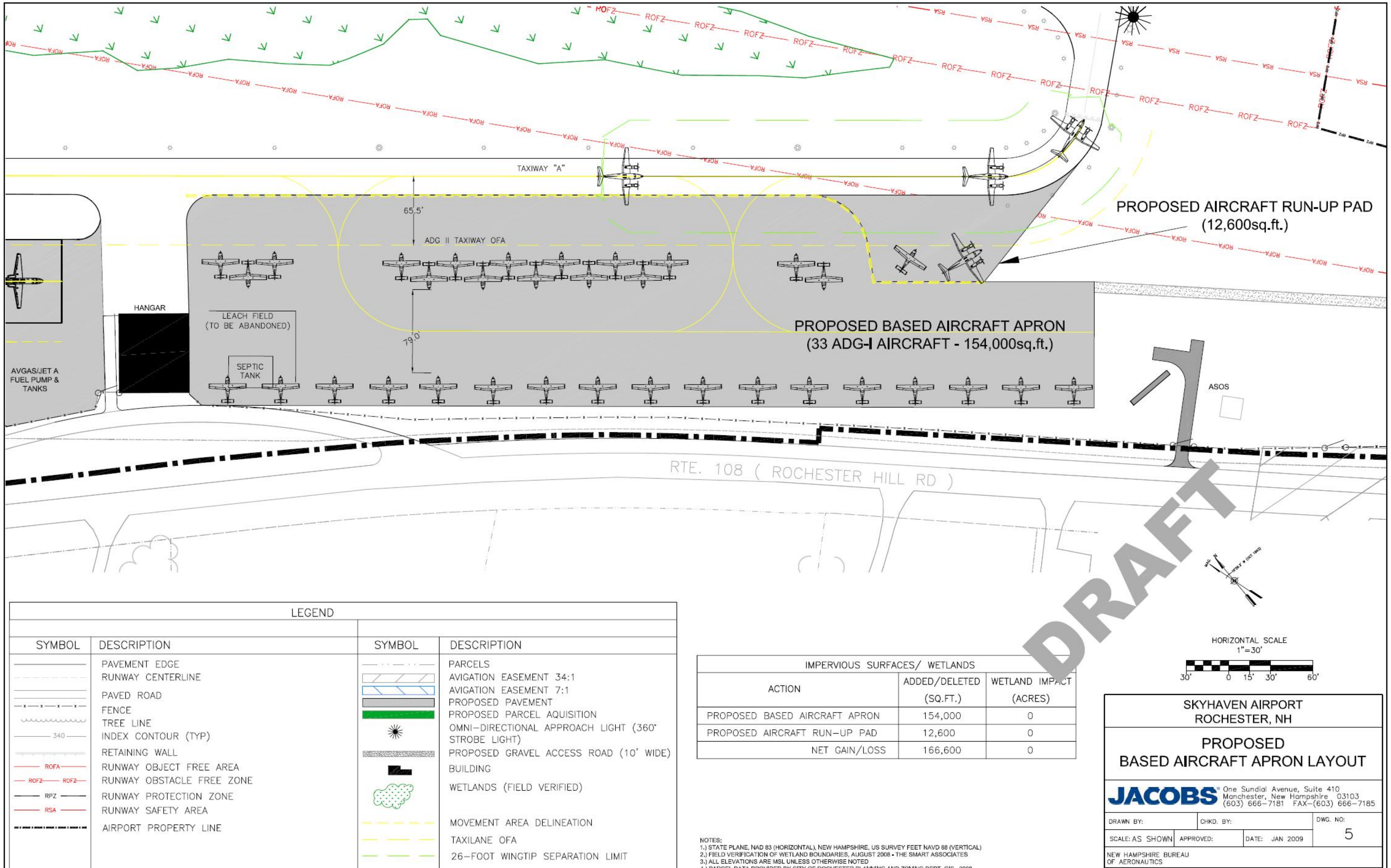
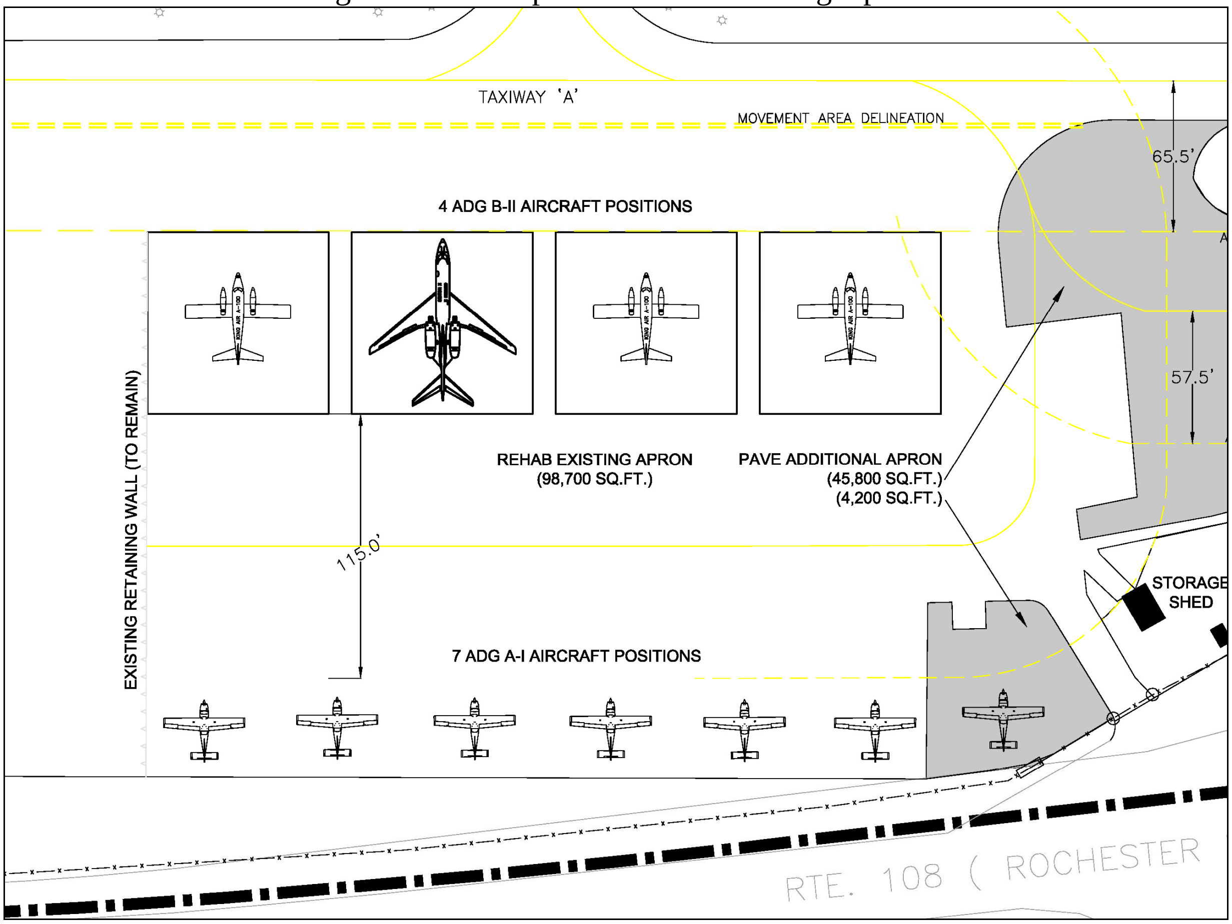

TAXIWAY "A"
65.5'
ADG II TAXIWAY OFA
79.0'
PROPOSED AIRCRAFT RUN-UP PAD
(12,600sq.ft.)
HANGAR
LEACH FIELD
(TO BE ABANDONED)
SEPTIC TANK
AVGAS/JET A FUEL PUMP & TANKS
PROPOSED BASED AIRCRAFT APRON
(33 ADG-I AIRCRAFT - 154,000sq.ft.)
ASOS
RTE. 108 (ROCHESTER HILL RD)
DRAFT
LEGEND
SYMBOL
DESCRIPTION
PAVEMENT EDGE
RUNWAY CENTERLINE
PAVED ROAD
FENCE
TREE LINE
INDEX CONTOUR (TYP)
RETAINING WALL
RUNWAY OBJECT FREE AREA
RUNWAY OBSTACLE FREE ZONE
RUNWAY PROTECTION ZONE
RUNWAY SAFETY AREA
AIRPORT PROPERTY LINE
PARCELS
AVIGATION EASEMENT 34:1
AVIGATION EASEMENT 7:1
PROPOSED PAVEMENT
PROPOSED PARCEL AQUISITION
OMNI-DIRECTIONAL APPROACH LIGHT (360° STROBE LIGHT)
PROPOSED GRAVEL ACCESS ROAD (10' WIDE)
BUILDING
WETLANDS (FIELD VERIFIED)
MOVEMENT AREA DELINEATION
TAXILANE OFA
26-FOOT WINGTIP SEPARATION LIMIT
IMPERVIOUS SURFACES/ WETLANDS
ACTION | ADDED/DELETED (SQ.FT.) | WETLAND IMPACT (ACRES)
PROPOSED BASED AIRCRAFT APRON | 154,000 | 0
PROPOSED AIRCRAFT RUN-UP PAD | 12,600 | 0
NET GAIN/LOSS | 166,600 | 0
NOTES:
1.) STATE PLANE, NAD 83 (HORIZONTAL), NEW HAMPSHIRE, US SURVEY FEET NAVD 88 (VERTICAL)
2.) FIELD VERIFICATION OF WETLAND BOUNDARIES, AUGUST 2008 - THE SMART ASSOCIATES
3.) ALL ELEVATIONS ARE MSL UNLESS OTHERWISE NOTED
4.) PARCEL DATA PROVIDED BY CITY OF ROCHESTER PLANNING AND ZONING DEPT. GIS - 2008
HORIZONTAL SCALE
1"=30'
30' 0 15' 30' 60'
SKYHAVEN AIRPORT
ROCHESTER, NH
PROPOSED
BASED AIRCRAFT APRON LAYOUT
JACOBS
One Sundial Avenue, Suite 410
Manchester, New Hampshire 03103
(603) 666-7181 FAX-(603) 666-7185
DRAWN BY:
CHKD. BY:
DWG. NO:
5
SCALE: AS SHOWN
APPROVED:
DATE: JAN 2009
NEW HAMPSHIRE BUREAU OF AERONAUTICS

Figure 4-4 Conceptual Transient Parking Apron



Each of the four corporate parking positions would allow power-in, power-out access. Seven parking positions for single and multi-engine piston airplanes (Design Group I) are also provided opposite the four corporate (Design Group II) parking positions. The smaller positions would be power-in, push-out, in order to more efficiently utilize the space available. The taxilane between the two groups would be 115 feet wide, the current FAA B-II taxilane object free area criteria.

The cost estimate to reconstruct the existing apron was based on full depth reconstruction to accommodate aircraft up to 60,000 lbs., and converting the apron to transient parking (as shown above). The cost estimate is approximately $1,355,000[10]. That does not include the cost to relocate the fuel pumps and tanks, or a new paved based aircraft tiedown apron, which are discussed below.

If this option were implemented, a new paved based aircraft tiedown apron (approximately 160,000 sq. ft.) would need to be constructed to replace the loss of paved tiedowns. The new based aircraft apron could be located over the existing turf tiedown area adjacent to the parallel

[10] Note: the cost estimates are approximate and subject to change. The cost estimates are not to be used for bidding or capital budgeting purposes. See Appendix B for cost estimate breakdowns.

taxiway. The existing septic tank and leach field will be removed in the near future, and the new paved apron could be constructed over that area, and also extend southeasterly along taxiway 'A' toward the end of Runway 33.

The apron layout was configured to maximize the capacity of the space available, and could accommodate approximately 32 based aircraft tiedowns, with a taxilane object free area width of 79-feet. It was assumed the based aircraft would all be piston-engine single and twins (i.e. Design Group I - wingspan < 49'). The tiedown apron would be served by two separate entrances, as depicted on the attached layout plan, and the cost estimate to construct this apron would be approximately $996,000[8]. The new tiedown apron and run-up pad combined would add 165,000 sq. ft. (approx.) of impervious surface. A run-up pad would be located at the south end of the apron, and would be separated by pavement markings (as shown).

A summary of the two apron alternatives is shown in Table 4-5. Construction methods to reduce the amount of impervious surface, such as using a porous pavement or pavers, or other new materials or construction techniques, should be considered in the design and construction of this apron.

Table 4-5

Aircraft Parking Apron Alternatives

Item	Benefits/Impacts	Cost Estimate	Additional Impervious Surface	Wetlands Impacts
Alternative A: Rebuild Existing Tiedown Apron	Least cost. No additional transient parking space.	$1.355M	No additional surface.	No impacts.
Alternative B: Convert Existing Tiedown Apron to Transient Parking + Construct New Based Apron	Provides additional transient and based aircraft parking space. Adds impervious surface + higher cost.	$1.355M +$.996 M $2.351 M	160,000 sq. ft.	No impacts.

Note: cost estimates are approximate and subject to change. The cost estimates do not include easement or property acquisition. The cost estimates are not to be used for bidding or capital budgeting purposes. See Appendix A for cost estimate breakdowns.

4.3-1 Self-serve Fuel Pumps

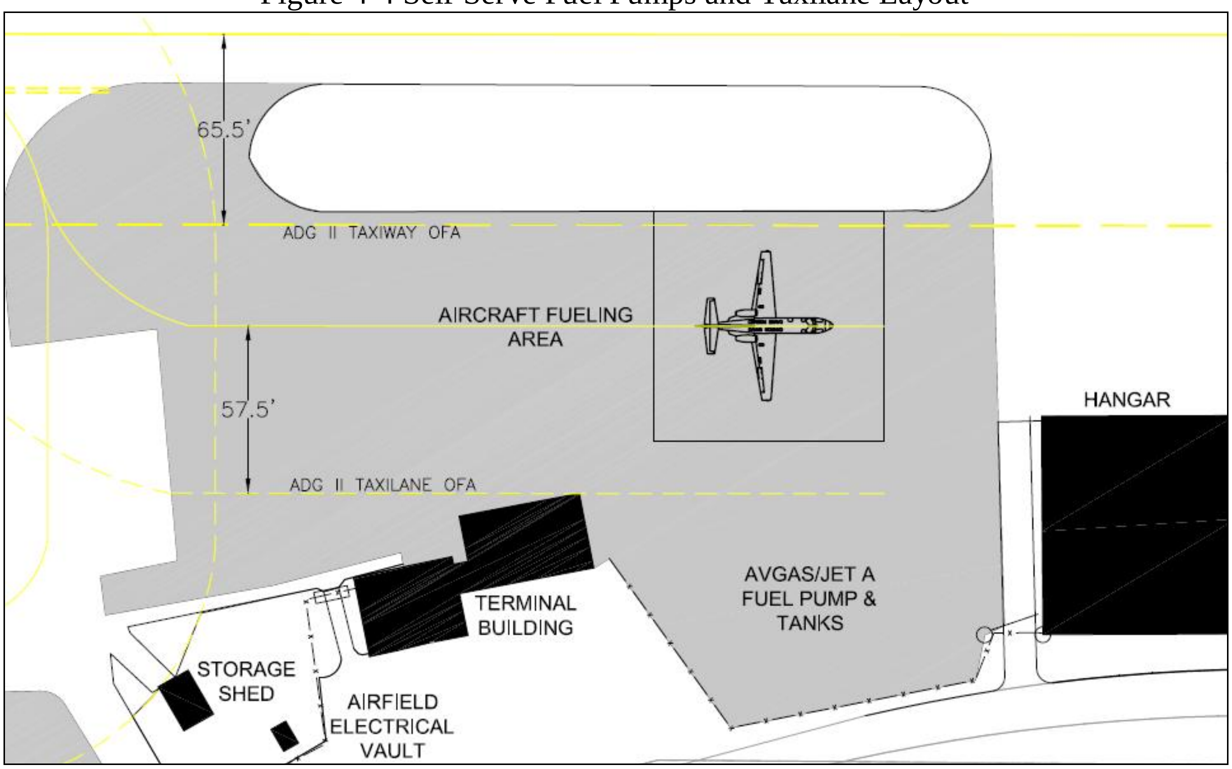
The self-serve fuel pumps for 100LL avgas and Jet A fuel are presently located on the based aircraft tiedown apron. Although fully functional, the existing fuel pumps are older, and some airport users have expressed a desire to replace the pumps with newer models. If the fuel pumps were relocated to the other side of the terminal building and a new taxilane was constructed dedicated for aircraft using the self-serve pumps, aircraft operational flow would be greatly enhanced by separating based and transient aircraft from those aircraft that are refueling. The cost of relocating and replacing the fuel pumps and existing fuel storage tanks is estimated to be approximately $448,000, not including the new taxilane.

The 2001 Master Plan Update did not recommend relocating the fuel pumps or fuel tanks, and the 2001 Terminal Area Plan did not reserve any site for such relocation. That plan, for example, shows a new hangar being constructed in the area besides the terminal building. If that area adjacent to the terminal building is reserved for hangar development, the new fuel pumps and storage tanks could be located either south of the existing hangar (where the new paved based tiedown apron would be located, thereby decreasing based aircraft tiedown capacity), or else north of the existing T-hangars.

One alternative to self-serve pumps is the use of mobile fuelers (fuel trucks). Trucks, however, require trained personnel to operate, and incur leasing, operating, insurance, and maintenance costs, and can only be used while trained personnel are on duty. As a result, fuel prices are higher when using mobile fuelers compared to self serve pumps.

Self-serve pumps for 100LL avgas are convenient (i.e. accessible 24/7) and because they cost less to operate than fuel trucks fuel prices are typically lower, and are therefore very popular with pilots. The proposed taxilane and new fuel pump layout (Figure 4-2) would allow both piston and turbine aircraft to power-in and power-out in front of the fuel pumps without interfering with transient or based aircraft parking.

Figure 4-4 Self-Serve Fuel Pumps and Taxilane Layout



Turbine powered aircraft typically do not use self-serve pumps. Corporate pilots prefer to have fuel trucks service their aircraft even though fuel price is typically more expensive, in part because turbine aircraft uplift more fuel which takes longer, and also the fueling process is more complex. As a result, in order to attract additional turbine aircraft to Skyhaven Airport, an FBO would need to be available to either provide mobile fuelers to sell and pump Jet A fuel, or else to fuel turbine aircraft from the fixed pumps.

4.4 Wetlands Impacts

Wetland impacts were calculated for the various alternatives using the approximate toe-of-slope limits for proposed improvements. For the ODALS, it was assumed that a 10-foot wide gravel road would be constructed in order to access and maintain the structures. For the Runway 15 extension (Runway Alternatives 2 and 3), it was assumed any wetland area left between the runway and the parallel taxiway would be considered "impacted" since isolating the wetland would result in a loss of functions and values.

The approximate areas of fill in wetlands (permanent impacts) for each alternative are shown in Table 4-6. In general, installation of an ODALS and gravel service road off of Runway 33 would result in approximately 0.15 acres of wetland impact. A 200-foot extension of Runway 33 would result in no wetlands impact. A 500-foot extension of Runway 15 would result in approximately 2.40 acres of wetland impact.

Each of the alternatives shown in Table 4-6 would result in fewer wetland impacts than identified in the 2004 wetland mitigation agreement between NHDOT and NHDES. Table 4-7 shows the wetland impacts outlined in the mitigation agreement. These impacts are based on the proposed improvements presented in the 2001 Airport Master Plan.

Table 4-6

Wetland Impacts

Alternative	**Area of fill in wetlands by wetland classification**[1]
Alternative 1 No runway extension + install ODALS on Runway 33	**0.15 acres of PEM1E** (0.15 acres of Wetland E)
Alternative 2 Extend Runway 33 by 200 feet + install ODALS on Runway 33 + extend Runway 15 by 500 feet	**2.55 acres of PEM1E** (0.15 acres of Wetland E + 2.40 acres of Wetland B)
Alternative 3 Extend Runway 15 by 500 feet + install ODALS on Runway 33	**2.55 acres of PEM1E** (0.15 acres of Wetland E + 2.40 acres of Wetland B)
Aircraft Parking – Alternative A Reconstruct Existing Based Aircraft Apron – No New Transient Parking Apron	None
Aircraft Parking – Alternative B Construct New Paved Based Aircraft Tiedown Apron + Reconstruct & Convert Existing Based Apron to Transient Parking Apron	None

1. Wetland classifications are in accordance with *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin, et al., 1979). PEM1E = palustrine, emergent, persistent, seasonally flooded/saturated.

The alternatives discussed in this Master Plan Update have different wetland impacts than the 2001 Master Plan, however the total acreage of wetland impact is less than the acreage outlined in the mitigation agreement.

The taxiway improvement project constructed in 2008 impacted approximately 5.5 acres of wetlands, which leaves approximately 6.34 acres of wetland in the mitigation agreement for future impacts. See attached figures for wetland areas.

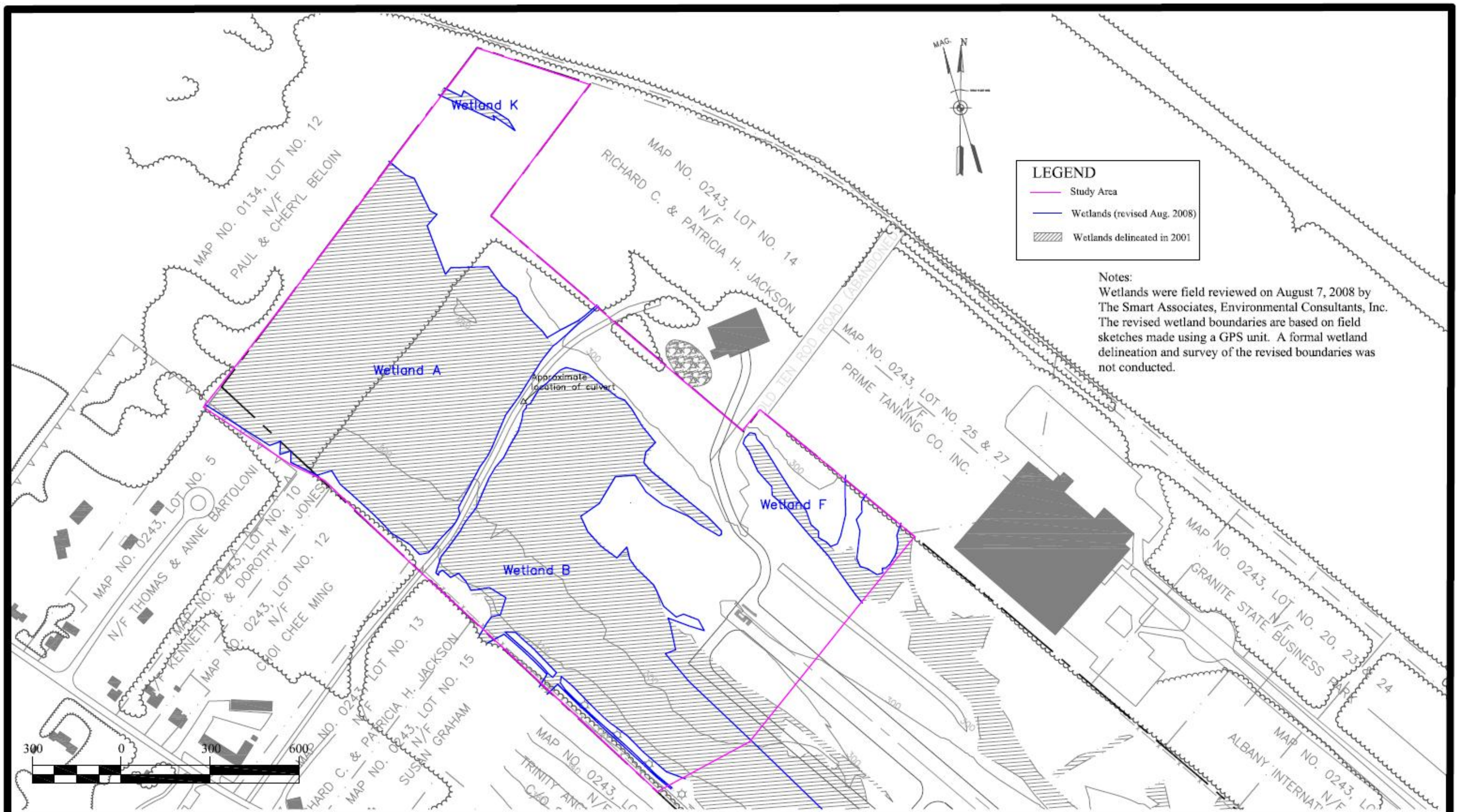
Table 4-7

Summary of 2004 Wetland Mitigation Agreement

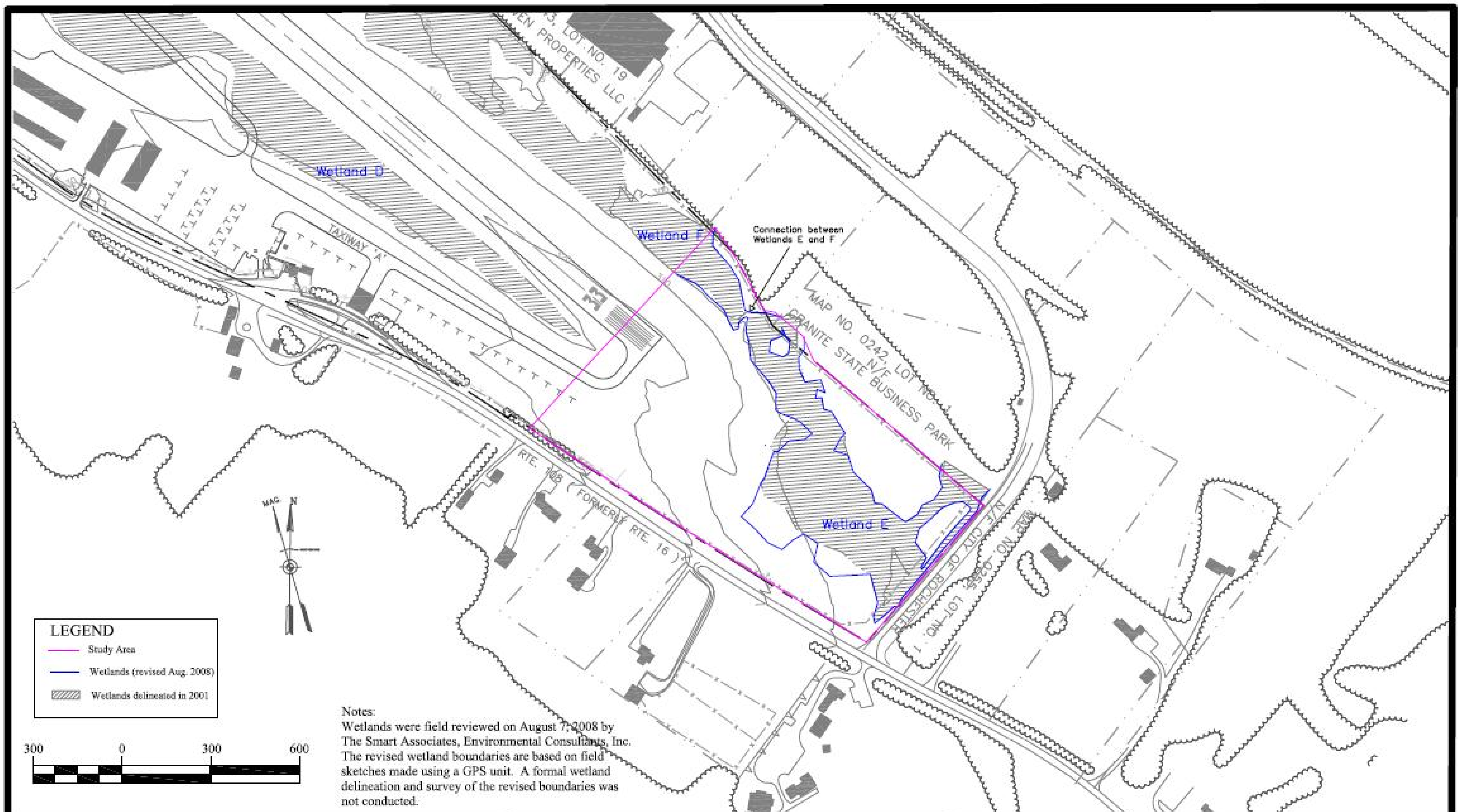
Proposed Improvements	Proposed Wetland Impacts (2001 Airport Master Plan)	Current Wetland Impacts
Hangar Construction	Wetland B – 1.85 acres Wetland C – 2.0 acres Wetland D – 1.0 acres **Total – 4.85 acres**	None (Not Yet Constructed)
Taxiway Improvements	Wetland D – 1.25 acres **Total – 1.25 acres**	5.5 acres (Constructed in 2008)
Runway Extension	Wetland B – 4.72 acres Wetland E – 1.02 acres **Total – 5.74 acres**	None (Not Yet Constructed)
Total	**11.84 acres**	**5.5 acres**

1. Information from Memo dated June 23, 2004 from NHDOT Division of Aeronautics to NHDES, NHDOT Bureau of Environment, Society for the Protection of NH Forests, City of Rochester, Russ Shillaber, Federal Aviation Administration, US Army Corps of Engineers, NH Fish & Game Department, and US Environmental Protection Agency.

Note: Wetland C is not shown on the attached figures. It is located near the existing T-Hangars and Taxiway A.



Skyhaven Airport Rochester, New Hampshire	Wetland Delineation Field Sketch Map 1 of 2 Airport Master Plan Update August 2008	The Smart Associates *Environmental Consultants, Inc.*



Skyhaven Airport Rochester, New Hampshire	Wetland Delineation Field Sketch Map 2 of 2 Airport Master Plan Update August 2008	The Smart Associates *Environmental Consultants, Inc.*

4.4-1 Water Quality and Permitting

Impacts to water quality were evaluated by quantifying the increase in impervious surface for each alternative, as shown in Table 4-8. Since large increases in impervious surfaces are likely to have negative effects on water quality, a contaminant loading analysis may be required by the NHDES as part of a Section 401 Water Quality Certification. The 700 foot Runway Extension (Alternative 2) and new Based Aircraft Parking Apron would likely require this analysis.

Table 4-8

Water Quality Impacts

Alternative	**Increase in impervious surface**	**Waters located downstream of improvements[1]**
Alternative 1 No runway extension + install ODALS on Runway 33	Minimal	Unnamed tributary to Blackwater Brook
Alternative 2 Extend Runway 33 by 200 feet + install ODALS on Runway 33 + extend Runway 15 by 500 feet	111,500 square feet	Unnamed tributary to Blackwater Brook Unnamed tributary to Wordley Brook
Alternative 3 Extend Runway 15 by 500 feet + install ODALS on Runway 33	74,400 square feet	Unnamed tributary to Blackwater Brook Unnamed tributary to Wordley Brook
Aircraft Parking – Alternative A Reconstruct Existing Based Aircraft Apron – No New Transient Parking Apron	None	N/A
Aircraft Parking – Alternative B Construct New Paved Based Aircraft Tiedown Apron + Reconstruct & Convert Existing Based Apron to Transient Parking Apron	201,850 square feet	Unnamed tributary to Blackwater Brook

1. Blackwater Brook and Wordley Brook are both tributaries to the Cocheco River.

In addition, those projects would also require an Alteration of Terrain Permit from the NHDES since they would disturb more than 100,000 square feet. Both the 700 foot and 500 foot runway extension options (Alternatives 2 and 3), and the new based aircraft parking apron, would also require coverage under the National Pollutant Discharge Elimination System (NPDES) Construction General Permit since they would involve more than 1 acre of disturbance.

A wellhead protection area is located just south of Airport property. Installing an ODALS off the end of Runway 33 would result in minor increases in impervious surfaces within the wellhead protection area.

There is also the potential for temporary impacts to the wellhead protection area during construction. Installation of an approach light system would involve the construction of two light poles and a gravel access road within the wellhead protection area. The new based aircraft parking apron, however, would be located outside of the wellhead protection area.

The majority of the Airport is located within a drinking water protection area. Alternatives that involve a significant amount of land disturbance during construction (such as the runway extension alternatives 2 and 3, and the new based aircraft parking apron), have a higher potential to negatively affect water quality in the area.

Various Best Management Practices (BMPs) could be used to mitigate water quality impacts resulting from these alternatives. Some of these BMPs could include porous pavement, infiltration basins, vegetated swales, vegetated filter strips, dry detention ponds, and wet ponds. The location of vegetated swales, detention ponds, and other BMPs that may contain standing water would need to be considered with respect to waterfowl. Such areas of standing water could attract waterfowl and other wildlife (such as deer, etc.) which could be a hazard to aircraft.

Table 4-9

Summary of Potential BMPs

	Description	**Maintenance**
Porous Pavement	Replaces traditional, impervious pavement. Stormwater infiltrates directly through pavement. Cost is generally at least twice as much as traditional asphalt.	Inspect regularly. Vacuum-sweep frequently to remove sediment (typically 3 to 4 times per year).
Infiltration Basin	Shallow impoundment which is designed to infiltrate stormwater into the soil. May not be successful at all sites due to specific soil requirements.	Semi-annual inspection and regular maintenance needed. Sediment needs to be removed every 5 years.
Vegetated Swale (Grassed Swale)	Vegetated open channel that slows runoff to allow sedimentation and/or infiltration.	Mow vegetation and inspect regularly. Remove sediment build-up from swale if needed.
Vegetated Filter Strip	Vegetated area that is designed to treat sheet flow from adjacent surfaces. Has not been shown to achieve high pollutant removal.	Mow vegetation and inspect regularly. Remove sediment build-up if needed.
Dry Detention Pond	Basin with an outlet designed to detain stormwater runoff for some minimum time (e.g. 24 hours) to allow particles and associated pollutants to settle. Does not have large pools of water.	Inspect regularly and mow side slopes. Remove sediment from the forebay (5 to 7 years). Remove sediment from the pond when the volume has been reduced by 25 percent (25 to 50 years)
Wet Pond	Basin that has a permanent pool of water throughout the year. Treats stormwater by allowing particles to settle and algae to take up nutrients.	Inspect regularly and mow side slopes. Remove sediment from the forebay (5 to 7 years). Remove sediment when pond volume has been reduced significantly or the pond becomes eutrophic.

*Information obtained from EPA’s National Menu of Stormwater Best Management Practices. http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm

Infiltration basins and vegetated filter strips could provide water quality treatment and would not create a potential wildlife hazard. Porous pavement could also be used to reduce the amount of pervious surface that is added and therefore reduce the amount of water quality impact. Maintenance for the above BMPs varies. Table 4-9 provides a summary of various BMPs that could be used to mitigate for water quality impacts.

4.5 Recommended Airport Layout

Based on the analysis presented above, considering the operational benefits of each option compared to the potential constraints, the recommended layout for Skyhaven Airport is summarized as follows:

Runway 15-33: Reconstruct the runway within the next five years (by 2014) in its existing location, 4,000’ long x 100’ wide. Although FAA criteria notes the runway should be 75 feet wide, because there is no crosswind runway, the current runway has less than 90% wind coverage, and the majority of aircraft operations are single-engine pistons, the runway should remain 100-feet wide to provide enhanced operational flexibility during crosswind conditions. The medium intensity runway lights (MIRLs) and electrical wiring should be replaced, and new drainage constructed as well. The runway pavement markings should be non-precision instrument on Runway 33, and visual on Runway 15.

Under certain scenarios it is possible that operations by corporate jets may increase to the point of crossing the threshold identified by FAA for extending the runway by the end of this planning period (2025). If corporate jets generate 500 or more operations (takeoffs and landings) per year, then Runway 15 and the associated parallel taxiway could be extended by 500 feet to allow for additional operational flexibility, specifically to allow jets to takeoff with additional payload (passengers and baggage), as well as fuel.

Any additional extension of Runway 15 to the north beyond 500 feet would result in increased wetlands and water quality impacts, as well as additional penetrations to the FAA imaginary surfaces. Extending Runway 33 to the south would result in the need to relocate the road and acquire property to maintain the runway protection zone, and acquire easements in order to remove additional penetrations to the imaginary surfaces, and would also move the approach light system (if it is constructed) further south as well.

A new aircraft run-up pad should be constructed in the vicinity the Runway 33 threshold to enhance operational flow of aircraft and prevent bottlenecks for departing aircraft.

New Instrument Approach Procedure: The FAA is in the process of publishing a new instrument approach procedure to Runway 33 – a non-precision Localizer Performance with Vertical Guidance (LPV) approach. In order to enhance its utility by lowering the approach visibility minimums from 1 mile to ¾ mile, an omni-directional approach light system (ODALS) should be installed to Runway 33. One light pole would be located off-airport and easements would need to be acquired to erect the light pole on private property.

Penetrations to the imaginary surfaces: There are existing penetrations to a number of FAA-defined imaginary surfaces in the vicinity of Skyhaven Airport. Most of the penetrations are vegetation, not man-made (i.e. buildings, cell towers). A determination should be requested from FAA to identify which penetrations are classified as hazards to air navigation and therefore need to be removed, and which penetrations are not hazards to air navigation, and may be lighted or marked. Once FAA has made that determination, the airport sponsor should implement the removal and lighting project.

Paved Aircraft Parking Apron: The existing based aircraft parking apron should be reconstructed and converted to transient aircraft parking. The apron could accommodate as many as four turbine-powered aircraft and seven piston-engine airplane parking positions.

Based Aircraft Parking Apron: A new paved based aircraft parking apron should be constructed south of the terminal building, adjacent to the parallel taxiway, to provide additional parking capacity.

Aircraft Self-Serve Fuel Pumps and Storage Tanks: The existing self-serve fuel pumps should be replaced with new pumps, and relocated to the other side of the terminal building. The fuel storage tanks should be relocated to the same area. A new taxilane to the self-serve pumps should be constructed to provide efficient access and eliminate interfering with other aircraft movements. A mobile fueler (fuel truck) should be used to pump Jet A fuel, which will require an FBO and trained personnel.

2001 Airport Master Plan Update

NHDOT has implemented a number of the recommendations presented in the 2001 Airport Master Plan Update, including the new SRE storage building, airport fencing, etc. Additional recommendations presented in that Master Plan Update include the construction of up to nine additional rows of T-hangars, as well as the construction of four conventional hangars.

NHDOT has a waiting list of aircraft owners who would like hangar space at Skyhaven Airport. Given the recent decline in general aviation activity locally and regionally, the aircraft owners on the waiting list should be contacted and confirm that they still want to lease hangar space at Skyhaven Airport. Based on that response, additional hangars could be constructed to meet that demand.

The 2001 Master Plan Update also recommended construction of paved aircraft tiedowns adjacent to the parallel taxiway towards the Runway 33 threshold, in a similar location recommended in this Master Plan for new based aircraft tiedowns.

APPENDIX 4A

COST ESTIMATES

Notes: cost estimates are approximate and subject to change.

The cost estimates are not to be used for bidding or capital budgeting purposes.

Table 4A-1
Summary of Cost Estimates

Description	Cost Estimate
Alt 1. Reconstruct R/W 15-33 4,000'x100'	$3.83M
Alt. 2 Extend R/W 15 x 500' & R/W 33 x 200'	$1.42M
Alt. 3 Extend R/W 15 x 500'	$1.04M
New Based Aircraft Apron	$1.00M
New Transient Aircraft Apron	$1.35M
Install ODALS & service road	$0.08M
Aircraft Fueling Facility	$0.45M
Notes: cost estimate numbers rounded to nearest $100,000. Cost estimates are approximate and subject to change.	

Table 4A-2

Reconstruct RW 15-33 4,000' x 100' = $3,827,940

Item Description	Qty.	Unit	Unit Cost	Total Cost
Unclassified Excavation	43500	CY	$ 10.00	$435,000
Subbase Course	30000	CY	$ 20.00	$600,000
Crushed Aggregate Base Course	8000	CY	$ 30.00	$240,000
Bituminous Concrete Pavement	11000	TON	$ 75.00	$825,000
Prime Coat	22000	GAL	$ 2.00	$44,000
Tack Coat	6500	GAL	$ 1.00	$6,500
Topsoil and Seed	15000	SY	$ 2.50	$37,500
Runway Edge Lighting System	1	LS	$375,000.00	$375,000
Drainage	1	LS	$200,000.00	$200,000
Subtotal				$2,763,000
Contingency (20%)				$552,600
Construction Total				**$3,315,600**
Engineering and Permitting				
Engineering -Design and Construction Phases (15%)				$497,340
Environmental Permitting	1	LS	$ 15,000.00	$15,000
Engineering and Permitting Total				**$512,340**
Total Design and Construction				**$3,827,940**

Reconstruct RW 15-33 4,000' x 75' = $3,142,790

Difference between 100' vs. 75' wide = + $685,150

Table 4A-3

Extend RW 15 by 500' + Extend RW 33 by 200'. Total Extension = 700'
Total Cost For Extensions = $1,421,634

Item Description	Qty.	Unit	Unit Cost	Total Cost
Unclassified Excavation	17500	CY	$ 10.00	$175,000
Embankment	5500	CY	$ 10.00	$55,000
Sub-base Course	8300	CY	$ 20.00	$166,000
Crushed Aggregate Base Course	2300	CY	$ 30.00	$69,000
Bituminous Concrete Pavement	3100	TON	$ 75.00	$232,500
Prime Coat	6200	GAL	$ 2.00	$12,400
Tack Coat	1900	GAL	$ 1.00	$1,900
Topsoil and Seed	25000	SY	$ 2.50	$62,500
Runway & Taxiway Edge Lighting System	1	LS	$125,000.00	$125,000
Drainage	1	LS	$120,000.00	$120,000
Subtotal				$1,019,300
Contingency (20%)				$203,860
Construction Total				**$1,223,160**
Engineering and Permitting				
Engineering Design and Construction Phases (15%)				$183,474
Environmental Permitting	1	LS	$ 15,000.00	$15,000
Engineering and Permitting Total				**$198,474**
Total Design and Construction				**$1,421,634**

Table 4B-4

Extend RW 15 by 500' Total Cost= $1,035,441				
Item Description	**Qty.**	**Unit**	**Unit Cost**	**Total Cost**
Construction				
Unclassified Excavation	13500	CY	$ 10.00	$135,000
Embankment	5500	CY	$ 10.00	$55,000
Sub-base Course	5500	CY	$ 20.00	$110,000
Crushed Aggregate Base Course	1500	CY	$ 30.00	$45,000
Bituminous Concrete Pavement	2100	TON	$ 75.00	$157,500
Prime Coat	4100	GAL	$ 2.00	$8,200
Tack Coat	1250	GAL	$ 1.00	$1,250
Topsoil and Seed	21000	SY	$ 2.50	$52,500
Runway & Taxiway Edge Lighting System	1	LS	$ 90,000.00	$90,000
Drainage	1	LS	$ 85,000.00	$85,000
Subtotal				$739,450
Contingency (20%)				$147,890
Construction Total				**$887,340**
Engineering and Permitting				
Engineering Design and Construction Phases (15%)				$133,101
Environmental Permitting	1	LS	$ 15,000.00	$15,000
Engineering and Permitting Total				**$148,101**
Total Design and Construction				**$1,035,441**

Table 4A-5

Construct New Based Aircraft Tiedown Apron Total Cost = $996,042				
Item Description	**Qty.**	**Unit**	**Unit Cost**	**Total Cost**
Construction				
Unclassified Excavation	13100	CY	$ 10.00	$131,000
Sub-base Course	8200	CY	$ 20.00	$164,000
Crushed Aggregate Base Course	2250	CY	$ 30.00	$67,500
Bituminous Concrete Pavement	3400	TON	$ 75.00	$255,000
Prime Coat	6700	GAL	$ 2.00	$13,400
Tack Coat	2000	GAL	$ 1.00	$2,000
Topsoil and Seed	5200	SY	$ 2.50	$13,000
Drainage	1	LS	$65,000.00	$65,000
Subtotal				$710,900
Contingency (20%)				$142,180
Construction Total				**$853,080**
Engineering and Permitting				
Engineering Design and Construction Phases (15%)				$127,962
Environmental Permitting	1	LS	$15,000.00	$15,000
Engineering and Permitting Total				**$142,962**
Total Design and Construction				**$996,042**

Table 4A-6

Reconstruct and Expand Existing Based Tiedown Apron and Convert it to New Transient Parking Apron
Total Cost = $1,354,739

Item Description	Qty.	Unit	Unit Cost	Total Cost
Construction				
Unclassified Excavation	17600	CY	$ 10.00	$176,000
Sub-base Course	12100	CY	$ 20.00	$242,000
Crushed Aggregate Base Course	3300	CY	$ 30.00	$99,000
Bituminous Concrete Pavement	4600	TON	$ 75.00	$345,000
Prime Coat	9000	GAL	$ 2.00	$18,000
Tack Coat	2700	GAL	$ 1.00	$2,700
Topsoil and Seed	1250	SY	$ 2.50	$3,125
Drainage	1	LS	$85,000.00	$85,000
Subtotal				$970,825
Contingency (20%)				$194,165
Construction Total				**$1,164,990**
Engineering and Permitting				
Engineering Design and Construction Phases (15%)				$174,749
Environmental Permitting	1	LS	$15,000.00	$15,000
Engineering and Permitting Total				**$189,749**
Total Design and Construction				**$1,354,739**

Table 4A-7

Install New Jet A & 100LL Aircraft Fuel Storage Tanks & Self-Serve Pumps
Total Cost = $447,980

Item Description	Qty.	Unit	Unit Cost	Total Cost
Construction				
AVGAS/Jet-A Tanks and Appurtenances	1	LS	$ 200,000	$200,000
Concrete Tank Pads, Misc Concrete, and Bollards	1	LS	$ 40,000	$40,000
Concrete Containment Vault	1	LS	$ 20,000	$20,000
Site Electrical Work	1	LS	$ 50,000	$50,000
Site Mechanical Work	1	LS	$ 15,000	$15,000
Demolition of Existing Aviation Fuel System	1	LS	$ 20,000	$20,000
Subtotal				$345,000
Contingency (20%)				$69,000
Construction Total				**$414,000**
Engineering and Permitting				
Engineering (7%)				$28,980
Environmental Permitting	1	LS	$ 5,000.00	$5,000
Engineering and Permitting Total				**$33,980**
Total Design and Construction				**$447,980**

APPENDIX 4B

New Global Positioning System (GPS) Instrument Approach Procedure

To runway 33

Localizer Performance with Vertical Guidance (LPV)

Executive Summary

An analysis of a new LPV (Localizer Performance with Vertical Guidance) instrument approach to Runway 33 at Skyhaven Airport was prepared, considering two alternatives:

1. Publish an LPV approach to the existing Runway 33 threshold.

2. Publish an LPV approach to the Runway 33 threshold extended 200 feet south of its existing location. In this scenario, additional obstacle removal would be required, as well as property acquisition, in order to achieve approach minimums as low as 300 ft. and ¾ mile.

Assumptions for New Instrument Approach to Runway 33, Skyhaven Airport		
	Existing Runway 33 Threshold	Runway 33 Threshold 200 feet South
Existing Runway 33 GPS Approach	HAT = 438 ft. Vis. = 1 mile	NA NA
Future LPV Approach	HAT = 300 ft. Vis. = ¾ mile [1]	HAT = 300 ft. Vis. = ¾ mile [1]
1. Visibility minimums with omni-directional approach light system (ODALS). Visibility without ODALS = 1 mile.		

Presently, when the visibility is less than 1 mile and/or clouds are lower than 438 feet above the runway, aircraft must land at another airport, such as Portsmouth International. The operational benefits of reducing the instrument approach minimums to 300 feet and ¾ mile would allow corporate and other general aviation aircraft to land more frequently at Skyhaven Airport in poor weather conditions.

Introduction

As noted previously, there are currently four instrument approaches published by the FAA to Skyhaven Airport. All four are non-precision approaches (i.e. no electronic vertical guidance), and the lowest visibility minimum is 1 mile. One of the primary objectives of this master plan update is to analyze the feasibility of implementing an LPV (Localizer Performance with Vertical Guidance) instrument approach to Runway 33 at Skyhaven Airport that would provide lower approach minimums than presently available. FAA's LPV approach criteria could allow visibility minimums as low as ½ mile. The focus of the master plan analysis is on Runway 33, based on direction provided by NHDOT officials and SAOC members.

The FAA has published new LPV approaches to airports throughout New Hampshire, including Portsmouth International, Manchester-Boston Regional, Laconia, etc. The FAA is currently analyzing LPV approaches to Runway 33 and Runway 15 at Skyhaven Airport, and the consultants and NHDOT have coordinated closely with FAA on their analysis.

One key difference between this Master Plan Update and the FAA's analysis is the location of the runway thresholds. The 2001 Master Plan Update recommended that Runway 15-33 be extended by 500 feet on either end of the runway, to a total length of 5,000 ft. This master plan update has identified and is analyzing alternative runway extension options, including the impact of publishing a new LPV approach to a runway threshold in a different location. The FAA is analyzing publishing a new LPV approach to the existing Runway 33 and 15 ends.

Several criteria promulgated by the FAA govern the analysis for a new LPV instrument approach to Runway 33, which were used in this analysis:

1. FAA Order 8260.3B, US Standard for Terminal Instrument Procedures (TERPs), Change 20, December 7, 2007
2. FAA Order 8260.54A, US Standard for Area Navigation (RNAV), December 7, 2007
3. FAA Advisory Circular (AC) 5300-13, Airport Design, Appendices 2 & 16 Change 14

These FAA AC's and Orders were used to determine and develop the applicable airspace surfaces for an LPV approach analysis to Runway 33.

Airspace Surfaces

Based on the criteria in the AC's and Orders above, several imaginary airspace surfaces were developed in AutoCAD and then imported into ArcView GIS applications for analysis. These surfaces include:

1. TERPs Glidepath Qualification Surface (GQS)
2. TERPs Precision Final Approach Segment
3. FAA Advisory Circular (AC) 5300-13 Appendix 2 Criteria
    a. Row 4 – Approach end of runways supporting instrument night circling
    b. Row 8 – Approach end of runways accommodating instrument approaches having visibility minimums ≥ ¾ but < 1 statute mile, day or night
    c. Row 11 – Departure runway ends for all instrument operations
4. TERPs Visual Portion of the Final Approach Segment
    a. Standard 20:1 Surface
    b. Straight-in 20:1 Surface
    c. Straight-in 34:1 Surface
5. TERPs Missed Approach Surface
6. FAR Part 77 Surfaces

Photogrammetric Survey

Once the relevant airspace surfaces were developed, Jacobs obtained aerial photogrammetric survey (prepared by Eastern Topographics, Inc.) out to a distance of approximately 4,000-feet from each runway end (approximately 200 acres on each end underlying a trapezoid to the extent of the Precision Final Approach Segment- the widest of the airspace surfaces analyzed.) This distance was based on an 80-foot tall vegetative object clearing the lowest airspace surface at a 50:1 obstacle clearance surface (OCS) starting 200-feet from the runway threshold. Manmade objects that normally exceed 80-feet such as cellular, water and transmission towers, are included in the FAA's Digital Obstruction File (DOF) and Aeronautical Data Sheet (ADS) and thus were already accounted for and included in the object database used for the analysis.

The photogrammetric survey points (treetop, building heights and high spots) were combined with the objects defined in the FAA's DOF and ADS to makeup the master object database against which the airspace surfaces were analyzed.

Assumptions

In analyzing the TERPs surfaces several assumptions have been made and are listed below:

- Airport Reference Code (ARC) = B-II
- FAR Part 77 - Utility Runway Not lower than ¾ mile visibility
- Glidepath Angle (GPA) = 3°
- Threshold Crossing Height (TCH)= 43.3-feet
- Height Above Touchdown ($HAT_{Elev.}$)= 296.0-feet
- Landing Threshold Point ($LTP_{Elev.}$) = 321.8-feet msl
- Decision Altitude (DA) = 617.8-feet msl

FAA Flight Procedures specialists noted that the FAA is currently in the process of programming an instrument approach to Runway 33 at Skyhaven Airport, which is scheduled for publication in October 2009. The approach will be published to the existing Runway 33 threshold, and will likely have a Height Above Touchdown (HAT) elevation of 300' and 1mile visibility. The specialist noted that an approach light system, such as an ODALS (Omni-directional Approach Light System), would allow the airport credit towards reducing the instrument approach minimums by a ¼ mile, down to ¾ mile visibility, if the approach light system were installed.

Airspace Surface Descriptions and Analysis Results

The airspace surfaces that were analyzed are described in detail below. This analysis was prepared based on an LPV approach published to the existing Runway 33 threshold. The impact of extending the Runway 33 threshold by 200 feet to the south was also analyzed. The number and type(s) of penetration(s) are listed with each associated airspace surface along with the number of parcels involved. Impact(s) that object penetrations have on these surfaces as well as any potential mitigation measures the airport sponsor can take to avoid instrument approach minimum penalties are also included with the surface description. A matrix of surfaces, number of penetrations and parcels in included at the end of this section.

Glidepath Qualification Surface (GQS)

This surface is described in FAA Order 8260.3B, Change 20, and serves as the litmus test for acquiring an LPV approach. The surface must be clear of obstacles for the runway end to be considered for an instrument approach with vertical guidance. As specified in Order 8260.3B, the GQS surface extends from the runway threshold along the runway centerline for a distance of 10,000 ft. and upward to an elevation equal to the decision altitude. There are 4 to the existing Runway 33 end GQS. The number of penetrations would increase to 15 if the runway were to be extended 200-feet.

Precision Final Approach Segment
This surface is comprised of 3 segments referred to as the "W", "X" and "Y" surfaces. A clear Obstacle Clearance Surface (OCS) allows for the lowest approach minimums, however if a penetration exists that cannot be removed, then several options exists:

1. Raise the glidepath angle
2. Displace the runway threshold
3. Raise the decision altitude

Numerous objects (228) were found to penetrate this surface and fell within 12 different parcels. Of the 228 penetrations, 108 were to the "W" surface (107 vegetative and 1 high spot) and 120 were to the "X" surface (4 buildings and 116 vegetative).

Approach end of runways expected to support instrument night circling
This obstacle clearance surface (OCS) is defined in FAA AC 150/5300-13, Airport Design, Appendix 2, Table A2-1. It begins 200-feet from the runway threshold at a width of 400-feet and extends 10,000-feet to a width of 3,400-feet. The OCS is 20:1. If this surface is penetrated, the recommended action is to displace the threshold. As noted in the AC, a displaced threshold may be avoided by lighting obstacle penetrations or the use of a VGSI (Vertical Glide Slope Indicator). No action is required for this surface as there are currently no penetrations.

Approach end of runways expected to accommodate instrument approaches having visibility minimums ≥ ¾ but < 1 statute mile, day or night
This surface is defined in FAA AC 150/5300-13 Appendix 2. It begins 200-feet from the runway threshold at a width of 800-feet and extends 10,000-feet to a width of 3,800-feet. The OCS is 20:1.

There are 74 penetrations to this surface (2 high spots and 72 vegetative). The objects penetrating this surface fell on 9 different parcels.

Departure Surface for Instrument Runways
FAA AC 150/5300-13 Appendix 2. It begins at the runway threshold at a width of 1,000-feet and extends 10,200-feet to a width of 6,466-feet. The OCS is 40:1. If the departure surface is penetrated, several possibilities exist for mitigation as noted in the AC:

1. Decrease takeoff distance available to preclude object penetration
2. Modify instrument departures. Objects penetrating by ≤ 35-feet may not require action, however they will impact departure minimums/climb gradients or departure procedures
3. Penetrations by existing obstacles ≤ 35-feet would not require TODA reduction or other mitigations, however they may affect new or existing departure procedures

There are 2,528 penetrations (2,511 vegetative and 17 high spots) to the departure surface occurring on 43 separate parcels.

Visual Portion of the Final Approach Segment – Standard and Straight-in

These surfaces defined in TERPs, evaluate whether night operations must be prohibited because of close-in obstructions unlighted obstacles or if visibility minimums must be restricted. There are three different surfaces evaluated under these criteria:

1. Standard 20:1 OCS – for runways which an aircraft is authorized to circle to land
2. Straight-in 20:1 and 34:1 OCS – for runways with an approach procedure is aligned with the runway centerline

The standard visual area begins 200-feet from the runway threshold at threshold elevation at a width of 400-feet and extends out 10,000-feet to a width of 3,400-feet. There are no penetrations to this surface.

The straight-in visual area also begins 200-feet from the runway threshold at threshold elevation at a width of 400-feet and extends out to the Decision Altitude (DA), 4,811.09-feet from the runway threshold at a width of 1,727.86-feet. This surface is evaluated with a 20:1 OCS and a 34:1 OCS. There are no penetrations to the 20:1 OCS. There are 44 penetrations to the 34:1 OCS on 4 different parcels. If these penetrations cannot be removed, then the approach visibility will be limited to ¾ miles.

Missed Approach

The missed approach segment is comprised of three sections: Section 1a, Section 1b and Section 1c. Section 1a of the missed approach surface begins at the Decision Altitude (DA) point and overlies the Precision Final Approach Segment "W" and "X" OCS, extending 1,460-feet in the direction of the missed approach. Section 1b begins at the end of Section 1a and extends to a point 9,860.69-feet from the DA, and splays along the extended final course to a total width of 1nautical mi. Section 1c are secondary areas that begin at the DA point and splay to a point on the edge and at the end of Section 1b at a slope of 7:1. There are no penetrations to the Missed Approach surface.

FAR Part 77 Imaginary Surfaces

The applicable guidelines specified within FAR Part 77 encompass several surfaces: the primary, approach, transitional, horizontal and conical. The extents of these surfaces are based on the runway category (utility or other-than-utility) and type of instrument approach (existing or planned) and visibility minimums to the runway. The surfaces for Runway 33 were developed based on the runway designation of utility category with non-precision approach not less than ¾ mile visibility.

Specific to Runway 33 there are 3 penetrations to the approach surface. The approach surface begins 200-feet from the threshold at a width of 500-feet and extends for 5,000-feet at a slope of 20:1 to an ultimate width of 2,000-feet.

A summary matrix of the surfaces analyzed is shown below.

Matrix of Airspace Surfaces

Surface	**Existing**		**Runway 33 Extended 200'**		**Diff.**
	Penetrations	**Parcels**	**Penetrations**	**Parcels**	

TERPS Glidepath Qualification Surface. 30:1 OCS	4	2	15	2	+11
TERPS Precision Final Approach Segment. 34:1 OCS	228	12	277	12	+49
AC 5300-13 Appendix 2 Row 4 Criteria – Approach end of runways expected to support instrument night circling. 20:1 OCS	0	0	7	2	+7
AC 5300-13 Appendix 2 Row 8 Criteria – Approach end of runways expected to accommodate instrument approaches having visibility minimums ≥ ¾ but < 1 statute mile, day or night. 20:1 OCS	74	9	117	9	+43
AC 5300-13 Appendix 2 Row 11 Criteria – Departure Surface. 40:1 OCS	2,528	43	3,308	45	+780
TERPS Visual Portion of the Final Approach Segment – Standard. 20:1 OCS	0	0	7	2	+7
TERPS Visual Portion of the Final Approach Segment – Straight-in. 20:1 OCS	0	0	8	2	+8
TERPS Visual Portion of the Final Approach Segment – Straight-in. 34:1 OCS	44	4	57	3	+13
TERPS Missed Approach	0	0	0	0	0
FAR Part 77 Approach Surface	3	1	n/a	n/a	n/a